

[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 23

[Docket No. ; Notice No.]

RIN: 2120-

Airworthiness Standards; Flight Proposals Based on European Joint Aviation Requirements Proposals

AGENCY: Federal Aviation Administration, DOT.

ACTION: Notice of proposed rulemaking.

SUMMARY: This notice proposes changes to the flight airworthiness standards for normal, utility, acrobatic, and commuter category airplanes. These proposals arise from the joint effort of the Federal Aviation Administration (FAA) and the European Joint Aviation Authorities (JAA) to harmonize the Federal Aviation Regulations (FAR) and the Joint Aviation Requirements (JAR) for airplanes that will be certificated in these categories. The proposed changes would provide nearly uniform flight airworthiness standards for airplanes certificated in the United States under 14 CFR part 23 (part 23) and in the JAA countries under Joint Aviation Requirements 23 (JAR 23) simplifying airworthiness approvals for import and export purposes.

DATES: Comments must be submitted on or before [Insert date 120 days after date of publication in the Federal Register].

ADDRESSES: Comments on this notice should be mailed in triplicate to: Federal Aviation Administration, Office of the

Chief Counsel, Attention: Rules Docket (AGC-200), Docket No.
 , 800 Independence Avenue, SW., Washington, DC 20591.

Comments delivered must be marked Docket No. . Comments
may be inspected in Room 915G weekdays between 8:30 a.m. and
5:00 p.m., except on Federal holidays.

In addition, the FAA is maintaining a duplicate information
docket of comments in the Office of the Assistant Chief Counsel,
ACE-7, Federal Aviation Administration, Central Region, 601 East
12th Street, Kansas City, Missouri 64106. Comments in the
duplicate information docket may be inspected in the Office of
the Assistant Chief Counsel weekdays, except Federal holidays,
between the hours of 7:30 a.m. and 4:00 p.m.

FOR FURTHER INFORMATION CONTACT: Frank Stogsdill, ACE-111, Small
Airplane Directorate, Aircraft Certification Service, Federal
Aviation Administration, 601 East 12th Street, Kansas City,
Missouri 64106; telephone (816) 426-5688.

SUPPLEMENTARY INFORMATION:

Comments Invited

Interested persons are invited to participate in the making
of the proposed rule by submitting such written data, views, or
arguments as they may desire. Comments relating to the
environmental, energy, or economic impact that might result from
adopting the proposals in this notice are also invited.

Substantive comments should be accompanied by cost estimates.
Comments should identify the regulatory docket or notice number

and should be submitted in triplicate to the Rules Docket address specified above. All comments received on or before the specified closing date for comments will be considered by the Administrator before taking action on this proposed rulemaking. The proposals contained in this notice may be changed in light of comments received. All comments received will be available, both before and after the closing date for comments, in the Rules Docket for examination by interested persons. A report summarizing each FAA public contact concerned with the substance of this proposal will be filed in the docket. Commenters wishing the FAA to acknowledge receipt of their comments submitted in response to this notice must include a preaddressed, stamped postcard on which the following statement is made: "Comments to Docket No. .". The postcard will be date stamped and returned to the commenter.

Availability of NPRM

Any person may obtain a copy of this Notice of Proposed Rulemaking (NPRM) by submitting a request to the Federal Aviation Administration, Office of Public Affairs, Attention: Public Inquiry Center, APA-200, 800 Independence Avenue, SW., Washington, DC 20591, or by calling (202) 267-3484. Communications must identify the notice number of this NPRM.

Persons interested in being placed on the mailing list for future NPRM's should request, from the above office, a copy of

Advisory Circular No. 11-2A, Notice of Proposed Rulemaking Distribution System, which describes the application procedure.

Background

At the June 1990 meeting of the JAA Council (consisting of JAA members from European countries) and the FAA, the FAA Administrator committed the FAA to support the harmonization of the FAR with the JAR being developed for use by the European authorities who are members of the JAA. In response to this commitment, the FAA Small Airplane Directorate established an FAA Harmonization Task Force to work with the JAR 23 Study Group to harmonize part 23 and the proposed JAR 23. The General Aviation Manufacturers Association (GAMA) also established a JAR 23/part 23 Committee to provide technical assistance in this effort.

Following a review of the first draft of proposed JAR 23, members of the FAA Harmonization Task Force and the GAMA Committee met in Brussels, Belgium for the October 1990 meeting of the JAR 23 Study Group. Representatives from the Association Europeenne des Constructeurs de Material Aerospatial (AECMA), an organization of European airframe manufacturers, also attended. The main agenda item for this meeting was the establishment of procedures to accomplish harmonization of the airworthiness standards for normal, utility, and acrobatic category airplanes. The JAA had decided that its initial rulemaking effort should be limited to these three categories and that commuter category airworthiness standards should be addressed separately.

After that meeting, technical representatives from each of the four organizations (GAMA, AECMA, FAA and JAA) met to resolve differences between the proposed JAR and part 23. This portion of the harmonization effort involved a number of separate meetings of specialists in the flight, airframe, powerplant, and systems disciplines. These meetings showed that harmonization would require revisions to both part 23 and the proposed JAR 23.

Near the end of the effort to harmonize the normal, utility, and acrobatic category airplane airworthiness standards, the JAA requested and received recommendations from its member countries on proposed airworthiness standards for commuter category airplanes. The JAA and the FAA held specialist and study group meetings to discuss these recommendations, which resulted in proposals to revise portions of the part 23 commuter category airworthiness standards.

Unlike European rulemaking, where commuter category airworthiness standards are separate, for U.S. rulemaking, it is advantageous to adopt normal, utility, acrobatic, and commuter category airworthiness standards simultaneously, since commuter category airworthiness standards are already contained in part 23. Accordingly, this NPRM proposes to revise the flight airworthiness standards for all part 23 airplanes.

During the part 23 harmonization effort, the FAA established an Aviation Rulemaking Advisory Committee (ARAC) (56 FR 2190, January 22, 1991), which held its first meeting on May 23, 1991 (56 FR 20492, May 3, 1991). The General Aviation and Business Airplane (GABA) Subcommittee was established at that meeting to

provide advice and recommendations to the Director, Aircraft Certification Service, FAA, regarding the airworthiness standards in part 23 as well as related provisions of parts 91 and 135 of the regulations.

The FAA announced, on June 2-5, 1992, at the JAA/FAA Harmonization Conference in Toronto, Ontario, Canada, that it would consolidate within the ARAC structure an ongoing objective to "harmonize" the JAR and the FAR. Coinciding with that announcement, the FAA assigned the GABA Subcommittee those rulemaking projects related to JAR 23/part 23 harmonization that were in final coordination between the JAA and the FAA. The harmonization process included the intention to present the results of JAA/FAA coordination to the public as NPRM's. Subsequently, the GABA Subcommittee established the JAR 23 Study Group.

The JAR 23 Study Group made recommendations to the GABA Subcommittee concerning the FAA's disposition of the rulemaking issues coordinated between the JAA and the FAA. The draft NPRM's previously prepared by the FAA harmonization team were made available to the harmonization working group to assist them in their effort.

The FAA received unsolicited comments from the JAA dated January 20, 1994, concerning issues that were left unresolved with the JAR 23 Study Group. The JAR/FAR 23 Harmonization Working Group did not address some of the unresolved issues because the JAA had not yet reached positions on those issues. Unresolved issues will be dealt with at future FAR/JAR

proposed in this document relate directly to final rule changes which were an outgrowth of the 1983 review. Amendment 23-43 (58 FR 18958, April 9, 1993) and Amendment 23-45 (58 FR 42136, August 6, 1993) are referenced in this document where relevant to the changes being proposed.

Discussion of Proposals

Section 1.1 General definitions.

This proposal would amend § 1.1 to add a definition of "maximum speed for stability characteristics, V_{rc}/M_{rc} ." This proposed change would harmonize part 1 and JAR 1. The definition is currently contained in § 23.175(b)(2) and also in § 25.253(b). Moving the definition to part 1 would simplify the text of part 23 and ease the referencing of the term V_{rc}/M_{rc} . The definition would be deleted from § 23.175(b)(2).

Section 23.3 Airplane categories.

This proposal would make a clarifying change to utility category maneuvers, change commuter category maneuvers and prohibit dual type certification of commuter category airplanes.

The limitation for utility category airplanes in § 23.3(b)(2) would be revised to add an outside limit of 90 degrees in angle of bank for lazy eights, chandelles, and steep turns.

Section 23.3(d) would be revised to delete chandelles and lazy eights as approved operations in commuter category airplanes because the FAA does not anticipate any operational need for such maneuvers.

category zero fuel weight requirement in § 23.25(a) to § 23.343. The FAA proposes removing the reference to both standby power rocket engines and to appendix E in § 23.25(a)(1)(iii) because this is a rare and obsolete design feature. If standby power rocket engines were proposed as a design feature, the FAA would issue special conditions to ensure adequate airworthiness.

Section 23.33 Propeller speed and pitch limits.

Proposed revisions to § 23.33(b)(1) would delete the reference to V_y and replace it with "the all engine(s) operating climb speed specified in § 23.65." This would be done for consistency with other changes in performance requirements. Section 23.33(b)(2) would be revised to use " V_{NE} " in place of "never exceed speed," since V_{NE} is defined in part 1, and to delete the word "placarded" which is unnecessary.

Section 23.45 General.

In Notice of Proposed Rulemaking, Small Airplane Airworthiness Review Program Notice No. 4, Notice No. 90-18 (55 FR 26534, June 28, 1990), the FAA requested comments on the need for weight, altitude, and temperature (WAT) criteria, as information or as a limitation on piston-powered, twin-engine part 23 airplanes. It also requested comments about WAT criteria on turbine-powered twin-engine part 23 airplanes, specifically during takeoff and landing.

WAT criteria is used to determine the maximum weight an airplane can have in relation to altitude and temperature for safe takeoff. This criteria provides a pilot with the information needed to determine if a takeoff and climb can be

successfully completed, including for multiengine airplanes, if one engine becomes inoperative. WAT criteria has been required under part 23 for commuter category airplanes, at all approved altitudes. A limited WAT criteria has been required for turbine engine powered airplanes at 5,000 feet and at standard temperature plus 40°F, but not for higher altitudes or temperatures. For some multiengine powered airplanes WAT data has been provided as information to pilots but is not required to be followed.

The FAA received three comments on mandating WAT criteria in part 23. One commenter (GAMA) "believes that WAT information is useful but certainly not the only way to present operating data for any airplane" and that making WAT criteria an airplane or operating limitation for part 23 airplanes is "an unnecessary and unjustified expansion or redirection of operating criteria."

Another commenter (ALPA) wants WAT information furnished during the certification process. The commenter cites the variety of operational uses of these airplanes including in scheduled air carrier and regional airline service. The commenter also cites the need for "one level" of safety as justification for expanding the WAT requirements.

The other commenter (JAA) also supports WAT criteria. This commenter believes that the chance of a single-engine failure on any airplane is high. Also, this commenter warns that safety considerations include airplane occupants and personnel on the ground. According to the commenter, transport category airplanes follow WAT criteria by limiting the operation of the airplane.

Beyond the point where takeoff can be rejected, one-engine-inoperative climbs must guarantee obstacle clearance. The commenter recognizes a need for generally similar requirements for commuter category airplanes.

The JAA believes that requiring a continued flight capability would preclude the operation of single-engine airplanes. Also, the commenter believes that airplane size and stall speed provide characteristics that permit safe landings in the event of an inoperative engine for single-engine airplanes and smaller multiengine airplanes.

The commenter points out that between the two extremes of the transport category airplane and the single-engine airplane lie the light twin-engine reciprocating airplanes and turbine engine airplanes, ranging from four seats to nine and from 4,000 to 12,500 pounds. The commenter notes that, for these types of airplanes, it would be burdensome to require compliance with full net flight path obstacle clearance. In the commenter's opinion, a safe forced landing becomes less satisfactory with increased takeoff weight, involving longer stopping distances even for the same landing speed. The commenter notes that the twin-engine airplanes have other significant adverse characteristics compared to single-engine airplanes. First, an engine failure is twice as probable; second, asymmetric power demands immediate pilot action.

The commenter also points out that the inability to continue flight with one engine inoperative creates the following situation: the chance of a second engine failure is increased; a

suitable site for an emergency landing is reduced; and the pilot resists the inevitable forced landing and tries to maintain flight. Training under more favorable conditions may have taught the pilot to expect success in those situations. In unfavorable conditions, attempts to maintain flight lead to loss of airspeed at high asymmetric power and, commonly, loss of directional control that results in a stall/spin accident.

The commenter advocates certification and operating criteria for multiengine airplanes that blend the performance requirements for a single-engine airplane and a transport category airplane. The commenter believes that the existing requirements accept a limited period of risk just before and just after liftoff, where engine failure may not be fully accounted for. The commenter believes that the application of WAT limits clearly accounts for actual conditions, although the climb gradient requirements are lower than the requirements of part 25/JAR 25.

The commenter proposes no distinction between reciprocating and turbine engines. In the commenter's opinion, the WAT criteria should be imposed, where applicable, as limitations through the Airplane Flight Manual (AFM).

The commenter does not believe that such proposals would involve costs disproportionate to the benefits. The commenter suggests that the comment from the Small Airplane Airworthiness Review Conference, held October 22-26, 1984, that such criteria would "eliminate the certification of an entire class of airplanes," is an exaggeration. The proposals are achievable, in the commenter's view, by typical modern light twin-engine

airplanes with realistic payloads, particularly the more significant executive/air taxi airplanes. The adoption of this concept, in the commenter's opinion, would instill a greater awareness of performance consideration in pilots from an early stage of their training.

The commenter also believes that the requirements on climb and handling qualities of the present §§ 23.65 and 23.67 are illogical and unreasonable. The commenter recommends using WAT criteria so that it applies equally to all airplane operations because it offers improved airplane capability.

The commenter points out that manufacturers of "WAT type" airplanes routinely determine performance under a wide range of conditions. The commenter also notes that flight manuals produced to the widely accepted General Aviation Manufacturers Association (GAMA) specification already contain performance data beyond the minimum requirements of part 23. In the commenter's opinion, additional testing or data scheduling create no additional costs.

To determine the necessity of applying WAT criteria to other than transport and commuter airplanes, the commenter notes that present draft JAR 23 applies WAT limits only to piston-engine airplanes above 6,000 pounds and turbine-engine airplanes. The JAR Operations Group proposes applying WAT limits to all JAR 23 airplanes in commercial operations.

In 1991, the FAA studied the accident record of reciprocating engine-powered, multiengine part 23 airplanes of over 6,000 pounds maximum takeoff weight with a substantial fleet

size. The FAA completed the study using the National Transportation Safety Board (NTSB) accident briefs and evaluating those statistics over the life of the individual airplanes. The statistics show the following:

(a) Over 100 accidents and 200 fatalities occurred due to engine failure during the study period.

(b) Forty-seven of the engine failure accidents occurred because the pilot failed to maintain flying speed and/or directional control.

(c) Engine reliability is a significant factor in the accident study. (For example, airplanes of similar or the same aerodynamic configuration, but with different engines, have significantly different accident records.)

After reviewing the accident statistics, and recognizing the performance capabilities of the accident airplanes, the FAA concludes the following:

(a) Engine reliability would not be of major concern if the airplane had adequate performance on the remaining operative engine.

(b) The loss of flying speed and subsequent loss of airplane control would not be a significant problem if the airplane exhibited adequate climb performance capabilities to fly out of an engine loss situation at low speeds.

Based on these statistics and conclusions from the FAA 1991 study and on comments, the FAA has determined that WAT limits are necessary for safe operation of multiengine airplanes of the type that will be involved in transporting passengers for hire.

Operating rules (part 135) are already in place that specify some performance limitations. The cutoff weight for reciprocating engine-powered airplanes of 6,000 pounds would encompass most airplanes of concern. All turbine engine-powered airplanes are included because of the adverse effect of increasing temperatures on turbine engine performance.

This proposal would change § 23.45 to require weight, altitude, and temperature (WAT) performance accountability for normal, utility, and acrobatic airplanes with a maximum takeoff weight over 6,000 pounds and all turbine-powered airplanes. Including WAT accountability necessitates reorganization and revisions to all paragraphs of this section. The inclusion of WAT accountability in part 23 also requires changes to several other sections in part 23.

Paragraph (a)(1) would be revised to require that performance requirements be met for still air and "standard atmosphere." Current (a)(1) uses the term "standard atmospheric conditions."

The applicability of paragraph (a)(1) and (2) would be revised to require that all airplanes meet the performance requirements for still air and standard atmosphere, and that ambient atmospheric conditions, which currently must be met by commuter category airplanes, would have to be met by (1) commuter category airplanes, (2) reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight, and (3) turbine engine-powered airplanes.

Proposed paragraph (b) would replace current requirements of paragraph (b) pertaining to power or thrust available with the altitude and temperature requirements for performance data.

Proposed § 23.45(c) is moved and modified from § 23.51. It would require that performance data be determined with the cowl flaps in the position used in cooling tests required by § 23.1041 to § 23.1047 and permits the cowl flap position to be addressed only once instead of at each individual performance paragraph.

Proposed paragraph (d) is the same as current paragraph (c) pertaining to the determination of available propulsion thrust. Proposed changes to § 23.45(b), (c), (d), and (e) would delete references to "thrust" and retain just "power," for standardization with the JAR. This is considered appropriate since power covers engine output, despite how the absorbed power is transmitted to the atmosphere. The FAA proposes this change in subsequent sections where the term "power or thrust" is used.

Proposed paragraph (e) is the same as requirements of current paragraph (d) with a minor editorial revision.

Proposed new paragraph (f) is based on current paragraphs (e)(3) and (e)(5)(i), which apply only to commuter category airplanes. Proposed changes to § 23.45(f) would extend to all airplane categories the requirement for all takeoff and landing procedures to be consistently executable by pilots of average skill. This is considered appropriate since takeoffs and landings must be made routinely by operational pilots. It is also appropriate that takeoff and landing performance published

in the Airplane Flight Manual (AFM) can be consistently achieved by operational pilots.

Proposed new paragraph (g) would require determining takeoff distance, accelerate-stop distance, takeoff distance and takeoff run, and landing distance on a smooth, dry, hard-surfaced runway. The FAA considers these limitations necessary for WAT limited airplanes since the WAT takeoff performance is only valid on a particular defined surface. The FAA does not consider the testing necessary to extend the same limitations to non-WAT airplanes burdensome to applicants since that information is already available in GAMA Spec. No. 1 AFMs. Additionally, the proposal allows for the derivation of landing and takeoff data on non-hard surfaces, such as grass and gravel and, thus, will not require additional flight testing.

Proposed new paragraph (h) is the same as current paragraph (e), which covers additional performance requirements for commuter category airplanes, except for some minor revisions. In the list of items to be determined in paragraph (h)(3), "landing distance" would not be included since it would already be covered in proposed § 23.45(g). A reference to § 23.67 in paragraph (h)(4) would be updated to be consistent with proposed revisions to that section in this notice; and the phrase "missed approaches" would be changed to "discontinued approaches" to be consistent with the proposed change to § 23.143. Proposed paragraph (h)(5)(i) requiring that the procedures must be able to be consistently executed by a crew of average skill would have added to it "in atmospheric conditions reasonably expected to be

encountered in service." These clarifying words would also appear in paragraph (h).

Section 23.49 Stalling speed.

Section 23.49 would be reorganized and edited for clarification. Currently the requirements for V_{so} and V_{s1} are separated. In the proposed section the requirements are merged except for the requirements now in current paragraph (b), which would be redesignated as paragraph (c) in the reorganization. The existing § 23.49(d) would be moved to § 23.49(b) and revised to clarify that the stall speed is to be determined under the same conditions at which the stall characteristics are determined.

Proposed changes to paragraph (a) are as follows:

(1) Proposed paragraph (a)(4) would be a requirement that the airplane be in the condition existing in the test, in which V_{so} and V_{s1} are being used.

(2) Proposed paragraph (a)(5) would be a revised version of current paragraph (a)(6). The current requirement states that the center of gravity must be in the most unfavorable position within the allowable landing range. The proposed requirement would state that the center of gravity must be in the position that results in the highest value of V_{so} and V_{s1} .

(3) As mentioned under § 23.45, the current paragraph (a)(5) is moved to § 23.45(c).

All of the changes are clarifying and not an increase in requirements.

Section 23.51 Takeoff speeds.

This proposal would revise the paragraph heading from "Takeoff" to "Takeoff speeds" and incorporate the takeoff speed requirements currently contained in § 23.53. This revision to the heading and reorganization of takeoff requirements is proposed for harmony with JAR 23.

Current § 23.51(a) would be moved. Current paragraph (a) requires that the distance required to take off and climb over a 50-foot obstacle must be determined with the engines operating within approved operating limitations and with cowl flaps in the normal takeoff position. These requirements as modified would be covered under proposed §§ 23.45(c) and (d) and 23.1587.

Current § 23.51(b) in measuring seaplane and amphibian takeoff distances would be deleted because it is a statement of an acceptable method of compliance. Also, there is not a need for addressing a separate seaplane starting point.

Current § 23.51(c) concerning pilot skills and conditions would be deleted since it would be covered under the general requirements in proposed § 23.45(f).

Current § 23.51(d) would be deleted because the requirements are partly covered under § 23.45 in commuter category performance and other performance requirements. In addition, the information requirements would be covered under § 23.1587. Subpart G, under which § 23.1587 appears, is generally used to specify what information must be in the AFM.

For multiengine normal, utility, and acrobatic category airplanes, the determination of V_r is transferred from § 23.53(a)

to proposed § 23.51(a) with minor changes in the specified rotation speed. For multiengine airplanes, in proposed paragraph (a)(1) the margin between rotation speed and V_{MC} increases to $1.05 V_{MC}$, and a margin of $1.10 V_{S1}$ is established between V_R and stall.

Proposed paragraph (a) would define V_R as the speed at which the pilot makes a control input, with the intention of lifting the airplane out of contact with the runway or water surface. This definition would apply to tail wheel and tricycle gear airplanes, seaplanes, and single-engine airplanes.

In addition to the multiengine rotation speed discussed above, proposed paragraph (a) would include rotation speeds for single-engine airplanes and seaplanes and amphibians. This proposed rule would extend V_R applicability to all part 23 airplanes to establish a safe and standardized procedure that can be used by operational pilots to achieve AFM takeoff performance. This proposed use of rotation speed is consistent with part 25.

In proposed paragraph (b) the speed at 50 feet is based on current § 23.53(b) with no change in requirements.

For commuter category airplanes, the takeoff speed requirements move from § 23.53(c) to proposed § 23.51(c) with editorial changes. The option in proposed (c)(1)(i) for an applicant to determine a V_{MCG} and establish a V_1 based on V_{MCG} rather than a margin above V_{MCA} is added.

Section 23.53 Takeoff performance.

The heading of § 23.53 and the content would be new. This section would now provide general takeoff performance requirements.

The proposal would move the takeoff speed requirements of the current § 23.53 to § 23.51. (See proposal for § 23.51.) Proposed § 23.53 provides general takeoff performance requirements for normal, utility, acrobatic, and commuter category airplanes. Proposed paragraph (a) is based on current § 23.51(a). Proposed paragraph (b) is a modification of current § 23.1587(a)(5). Proposed paragraph (c) is based on § 23.51(d).

Section 23.55 Accelerate-stop distance.

This proposal would revise § 23.55 to clarify the accelerate-stop segments and to make editorial changes.

This proposal would divide the accelerate-stop maneuver into three segments, rest to V_{EF} (proposed (a)(1)), V_{EF} to V_1 (proposed (a)(2)), and V_1 to rest (proposed (a)(3)). This is not a new requirement, but it divides the total distance into three segments to be considered. The phrase, "in the case of engine failure," in current § 23.55(a)(2) would be deleted because it would be included in proposed (a)(2). Also, the phrase, "assuming that . . . the pilot has decided to stop as indicated by application of the first retarding means at the speed V_1 ," is deleted because it is stated in proposed § 23.51(c)(1)(ii). The "exceptional skill" phrase of § 23.55(b)(3) would be deleted because it will remain in proposed § 23.45(h)(5)(i). The

§ 23.55(b) phrase "if that means is available with the critical engine inoperative" would be deleted because it is covered by the safe and reliable requirements.

Section 23.57 Takeoff path.

Section 23.57 would be revised to clarify and specify which takeoff path segments must be determined in flight. Proposed paragraph (a) would clarify that the transition to the enroute configuration should be completed on or before reaching 1500 feet above the takeoff surface. In current § 23.57(c)(1), the slope of the airborne part of the takeoff path must be "positive at each point"; this is changed in proposed (c)(1) to "not negative at any point," to allow acceleration in level flight, which is implied by current § 23.61(c). A proposed editorial change to § 23.57(c)(3) would specify that the climb gradient "must not be less than . . .," as opposed to "may not be less than. . . ." The option in current § 23.57(d) of determining the takeoff path, either by continuous demonstration or by synthesis from segments, no longer reflects current practice, nor is it entirely desirable. The only viable option in determining the takeoff path from rest to 35 feet above the takeoff surface is by a continuous demonstration. The most practical method of determining the takeoff path from 35 feet to 1500 feet above the takeoff surface is by synthesis from segments. Accordingly, proposed § 23.57(d) and (e) would incorporate these changes.

Section 23.59 Takeoff distance and takeoff run.

This proposal would clarify § 23.59 with no substantial change in requirements. The proposal would change the opening

text to clarify that the determination of takeoff run is the applicant's option since the applicant may choose not to present clearway data. The reference in current § 23.59(a)(2) and (b)(2) to "along the takeoff path," in a takeoff with all engines operating, would be deleted since takeoff path is a one-engine-inoperative condition. Additionally, V_{LOF} is changed to liftoff point to clarify that the requirements specify a point and related distance, not a speed.

Section 23.63 Climbs: general.

Proposed new § 23.63 would assemble general climb requirements from §§ 23.65 and 23.67 into a single section and differentiate between WAT limited airplanes (reciprocating engine powered airplanes of above 6,000 pounds maximum takeoff weight and all turbine engine powered airplanes) and those airplanes that are not WAT limited (reciprocating engine powered airplanes of 6,000 pounds or less). (See the proposed change to § 23.45 for discussion of WAT limits.) Proposed new § 23.63(a)(1) would require that compliance be shown out of ground effect. This requirement is in current § 23.67(e), which applies to commuter category airplanes. For many years FAA policy has been that the only acceptable method of compliance has been to determine climb performance out of ground effect. Proposed new § 23.63(a)(3) requires that compliance must be shown, unless otherwise specified, with one engine inoperative, at a bank angle not exceeding 5 degrees. This requirement is in current § 23.149 and has been applied generally for part 23 airplanes except commuter category airplanes in certain circumstances.

Section 23.65 Climb: All engines operating.

This proposal would clarify § 23.65 and would change minimum climb speeds for multiengine airplanes.

Proposed revisions to § 23.65(a) would change the applicability from "each airplane" as adopted in Amendment 23-45, (58 FR 42136, August 6, 1993) to "each normal, utility, and acrobatic category reciprocating engine-powered airplane of 6,000 pounds or less maximum weight." It would change the phrase "angle of climb" to "climb gradient" and establish the climb gradient at 8.3 percent for landplanes and 6.7 percent for seaplanes and amphibians with certain specified performance conditions.

Proposed (a)(4) would establish a minimum climb speed for multiengine airplanes of not less than the greater of $1.1 V_{MC}$ and $1.2 V_{S1}$, which would provide a margin above V_{MC} .

The cowl flap requirements currently in paragraph (a)(5) would be moved to § 23.45(c).

Current § 23.65(b) would be deleted. These requirements should have been deleted in Amendment 23-45 (58 FR 42136, August 6, 1993), but they were overlooked. Since the adoption of Amendment 23-45 there is no longer a rate of climb requirement in § 23.65(a). The alternative means of compliance allowed by paragraph (b), therefore, is obsolete and not consistent with the more stringent performance requirements proposed by this NPRM. Also, the alternative means of compliance in paragraph (b) was rarely used by applicants.

The proposed § 23.65(b) would add WAT limits for reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight and turbine engine-powered airplanes. (See proposal for § 23.45 for discussion of WAT limits.)

Current § 23.65(c) would be moved to § 23.65(b) and the temperature and altitude would be deleted since WAT limits are proposed for turbine engine-powered airplanes and the four percent gradient would apply at any approved takeoff ambient condition. Proposed § 23.65(b)(2) provides for landing gear down unless the gear can be retracted in not more than seven seconds. This is more stringent than the present requirement, but the same as the proposed one-engine-inoperative takeoff climb requirements, and is considered appropriate to this weight and class of airplane with WAT limits.

Current § 23.65(d) would be deleted since the requirements are already covered in the proposed § 23.45(h)(2) and current § 23.21.

Section 23.66 Takeoff climb; one-engine inoperative.

Proposed new § 23.66 would require the determination of the one-engine-inoperative climb capability of all WAT limited reciprocating engine-powered and turbine engine-powered airplanes immediately after takeoff. Since most reciprocating engine-powered airplanes do not have autofeather, the condition immediately after takeoff can be critical. There is not a minimum climb requirement in this configuration, only the determination of the climb or descent gradient. This information does not become a limitation; it is provided to the pilot in the

AFM (see § 23.1587) to allow the pilot to make informed judgments before takeoff.

Section 23.67 Climb: one engine inoperative.

This proposal would reorganize § 23.67 for harmonization with the JAR; and would require WAT limits for some airplanes; require wings level climb up to 400 feet for commuter category airplanes, and make minor changes in airplane configuration requirements.

Revised § 23.67(a) would specify the climb requirements for non-WAT airplanes with no change in requirements for those airplanes.

Proposed § 23.67(b) would specify climb requirements for WAT airplanes. WAT criteria would be applied for both reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight and turbine engine-powered airplanes. (See the discussion of WAT limits in the proposed change to § 23.45.) Turbine engine-powered airplanes are currently subject to limited WAT limitations under § 23.67(c), which would be incorporated into proposed § 23.67(b).

The takeoff flap position for normal, utility, and acrobatic category reciprocating engine-powered airplanes of 6,000 pounds or less is changed to "wing flaps retracted" from "most favorable position" (current § 23.67(4)). Wing flaps retracted is the position most used in certification and in service for this size of airplane. The proposed change is contained in § 23.67(a)(1)(iv), (a)(2)(iv), and (b)(2)(iv).

Current § 23.67(d) is deleted since all climb speeds (both all-engine and one engine inoperative) are scheduled and the determination of V_y is no longer required. V_y is also proposed to be deleted in all other sections of part 23 for the same reason.

Current § 23.67(e) for commuter category airplanes would be redesignated as § 23.67(c) with no change in requirements except that the takeoff climb with landing gear extended must be conducted with the landing gear doors open. This is a conservative approach offered by the JAA to specify a definite gear door configuration and to delete the requirement to determine performance during the transient condition of gear doors opening and closing. Proposed § 23.67(c)(1) specifies that the first segment climb must be conducted with the wings level and further specifies that the climb speed for the segment must be V_2 instead of the current requirement for a range of speeds from V_{Lof} and whatever the applicant selects at gear retraction. Proposed § 23.67(c)(2) requires conducting the second segment climb with wings level, which would be appropriate for operational scenarios.

The current § 23.67(e)(1) requirements are partially moved to § 23.67(c) and the remainder are contained in § 23.63(a)(1) and (d).

Proposed § 23.67(c)(3), enroute climb, adds a minimum climb speed to ensure an adequate margin above stall speed.

The proposed § 23.67(c)(4) makes no substantive changes in the current requirements of § 23.67(e)(3) but does change the

paragraph heading from "Approach" to "Discontinued approach." In addition, proposed § 23.67(c)(4) clarifies that the climb gradients must be met at an altitude of 400 feet above the landing surface.

Section 23.69 Enroute climb/descent.

Proposed new § 23.69 would require the determination of all engine and one-engine-inoperative climb/descent rates and gradients in the enroute configuration under all operational WAT conditions. This information is necessary for enroute flight planning and dispatch. Climb speeds are specified to provide a margin above V_{SI} .

Section 23.71 Glide: Single-engine airplanes.

Proposed new § 23.71 would require the determination of glide distance and speed for single-engine airplanes. The information is necessary for flight planning and for providing the pilot with information from which to make informed decisions.

Section 23.73 Reference landing approach speed.

Proposed new § 23.73 would define the reference landing approach speeds, V_{REF} . Establishing a definition for these speeds simplifies the use of V_{REF} in other portions of the rule. The V_{REF} speeds for the various category airplanes are established as not less than $1.3 V_{SO}$. Also, the established speeds consider the appropriate relationship to V_{MC} determined under § 23.149.

Section 23.75 Landing distance.

This proposal would reorganize § 23.75 for harmonization with the JAR, add the landing reference speed, V_{REF} , and delete the portion on brake pressures.

The introductory paragraph of this section would be revised to delete the reference to the AFM because part 23, subpart B, is generally used to specify what must be determined during flight test and part 23, subpart G, is generally used to specify what must be placed in the AFM. The introductory paragraph would also be revised to require landing distances to be determined at standard temperature for each weight and altitude. Service experience has shown that landing distances are not sensitive to temperatures. The use of standard temperature is consistent with WAT requirements and the increased level of safety introduced in this NPRM. The revised introductory paragraph deletes the reference to "approximately 3 knots" for seaplanes and amphibians because this information will be moved to advisory material on acceptable methods of compliance.

Revised § 23.75(a) adds V_{REF} and requires its use. (See proposal for § 23.73.)

The text of the current § 23.75(b) is deleted because proposed § 23.45 would specify these general requirements. Proposed new § 23.75(b) clarifies that a constant configuration must be maintained throughout the maneuver.

Revised § 23.75(d) would continue the current requirement for showing that a safe transition to the balked landing conditions can be made and specify the weight that must be considered for the transition to the balked landing conditions. This proposed new requirement reflects current industry practice.

Current § 23.75(e), concerning pressure limits on wheel brakes, is moved to proposed § 23.735, Brakes. (See the Systems

FAR/JAR Harmonization NPRM.) The brake pressure requirement is more appropriately a systems requirement and the test pilot lacks a practical way to determine compliance. Proposed new § 23.75(e) is a general requirement to ensure the reliability of the brakes and tires.

Proposed § 23.75(f) is revised by changing the first use of the word "means" to "retardation means," and by deleting paragraph (f)(3). Paragraph (f)(3) requires that no more than average skill shall be required to control the airplane. This topic is covered in proposed § 23.45(f).

Section 23.75(h) is deleted because the introductory paragraph of proposed § 23.75 would contain commuter category requirements and proposed § 23.1587 would require landing distance correction factors.

Section 23.77 Balked landing.

This section would be revised to include additional WAT requirements and to make editorial changes.

Proposed revisions to § 23.77(a) and (b) would differentiate between WAT and non-WAT; and, in paragraph (b), would include the more stringent WAT limited airplane requirements. (See proposal for § 23.45.) Section 23.77(a)(4) adds a new climb speed requirement to ensure that acceleration is not required during the transition from landing to balked landing. The climb gradient of § 23.77(b) was selected to be slightly less than the non-WAT airplane sea level requirement as a tradeoff for a balked landing climb capability at all altitudes and temperatures.

The commuter category climb gradient of 3.3 percent specified in § 23.77(c) changes to 3.2 percent for consistency with part 25. Additional editorial changes and deletions are proposed for § 23.77(c) because the general requirements would be covered in the proposed § 23.45.

Section 23.143 General.

Proposed § 23.143(a) would be revised to add the phrase "during all flight phases" to the lead-in of the paragraph. "Go-around" would be added to the list of flight phases.

The JAA/FAA decided, during FAR/JAR Harmonization meetings, that the term "go-around" included the all engine bailed landings of § 23.77, various all engine and one-engine-inoperative aborted landings specified in the AFM, and the commuter category discontinued approach of § 23.67(c)(4). In this NPRM, bailed landing refers only to the all engine bailed landing of § 23.77.

The table in paragraph (c) would be changed to show a change in two-hand roll force from 60 to 50 pounds, which is consistent with JAR 25. The table also would be changed to show a one-hand on the rim roll force of 25 pounds. This is a JAA/FAA harmonized value.

Section 23.145 Longitudinal Control.

Proposed § 23.145 would be revised by changing the speed ranges applicable to the takeoff, enroute, and landing configurations. In proposed paragraph (b)(2) the requirement for "altering and maintaining, as a minimum, the speed used to show compliance with § 23.77" would be changed to "to allow the airspeed to transition from $1.3 V_{so}$ to $1.3 V_{s1}$." In proposed

paragraph (b)(5) for landing configuration, the speed reference would be changed from $1.4 V_{so}$ to V_{REF} .

Editorial changes are also proposed for the lead-in to paragraph (b) with no substantive change.

Current paragraphs (b)(2)(i) and (ii) would be redesignated as (b)(2) and (b)(3), respectively.

Proposed paragraph (b)(3) would add more specific requirements if gated flap positions are used.

Proposed paragraph (b)(4) is the same as current paragraph (b)(4). Proposed paragraph (b)(5) is the same as current paragraph (b)(5) except for changes in trim speed to V_{REF} and the allowance of a two-handed control. Use of two hands is considered appropriate because the pilot does not need to change power settings.

Proposed paragraph (b)(6) is current paragraph (b)(3).

Proposed paragraph (c) would change the speed range for maneuvering capability from "above V_{MO}/M_{MO} and up to V_D/M_D " to "above V_{MO}/M_{MO} and up to the maximum speed shown under § 23.251." This change is considered necessary because a range of speeds can be chosen as V_D/M_D . Reference to § 23.251 would ensure a flight demonstrated speed instead of a design speed.

Proposed paragraph (d) would change the speed that must be maintained for power-off glide from $1.3 V_{so}$ to V_{REF} .

Section 23.147 Directional and lateral control.

This proposal would make minor revisions to § 23.147(a) and add two new requirements in proposed paragraphs (b) and (c). The flaps retracted configuration for § 23.127(a)(4) would be consistent with the proposed § 23.67.

Proposed § 23.147(b) would add a test for the condition when, during enroute climb, an engine fails and a time delay of two seconds occurs before the pilot takes corrective action. The intent of this proposed change is to test for a likely operational scenario and to ensure a satisfactory result.

Proposed § 23.147(c) would test for the failure or disconnection of the primary lateral control. This paragraph requires that the airplane exhibit adequate dihedral effect throughout the airplane's operational envelope to ensure continued safe flight and landings if a lateral control disconnects. In addition, this requirement provides compatibility with the relaxed requirements of proposed § 23.177(b) (see proposal for § 23.177).

Section 23.149 Minimum control speed.

This proposal would clarify § 23.149, add a V_{MC} in the landing configuration, and provide the procedure for determining a ground V_{MC} .

Current § 23.149(a) would be revised in the proposal by making clarifying and editorial changes with no change in requirements. Section 23.149(b) would be revised by making

clarifying changes and deleting the reference to lesser weights in paragraph (b)(4) because the range of weights is covered in § 23.21.

Proposed § 23.149(c) specifies the requirements for a V_{MC} in the landing configuration for WAT and commuter airplanes. This proposed new requirement is necessary for airplanes in this category to provide a V_{REF} margin above the V_{MC} determined in the landing configuration. (See proposal for § 23.73.)

The new § 23.149(f) proposes the requirements for determining a V_{MCG} for commuter category airplanes, at the option of the applicant, to comply with § 23.51. (See proposal for § 23.51.)

Section 23.153 Control during landings.

This proposal would revise § 23.153 to reference landing speeds to V_{REF} and to reorganize the section.

Section 23.155 Elevator control forces in maneuvers.

Proposed § 23.155 would make changes to the power and gradient of the stick force curve.

Proposed § 23.155(b) specifies the maximum continuous power for the test instead of allowing a power selected by the applicant as an operating limitation. This revision would eliminate a power specification that is unnecessary and would simplify normal operations for the pilot.

Proposed § 23.155(c) addresses stick force gradient to ensure that stick force lightening is not excessive. The FAA will issue advisory material on acceptable methods of compliance.

Section 23.157 Rate of roll.

This proposal would revise § 23.157(d) power and trim requirements and would clarify the flap position. Proposed § 23.157(d)(1) would clarify that the flaps should be in the landing position. Proposed § 23.157(d)(3) would make the power consistent with the approach configuration, which is the configuration being tested. Proposed § 23.157(d)(4) would relate the trim speed to the proposed V_{REF} . (See proposal for § 23.73.)

Section 23.161 Trim.

This proposal would revise § 23.161 power, configurations, and speeds.

Proposed § 23.161(a) would state the safety principles underlying the trim requirements and would provide a regulatory requirement for considering conditions that might be encountered outside the requirements addressed in paragraphs (b) through (d).

Proposed § 23.161(b)(1) would add a requirement to trim at M_{MO} in addition to V_{MO} . This proposed change only clarifies that the airplane must trim in the Mach limited speed range.

Proposed § 23.161(b)(2) would require lateral and directional trim over a range of $1.4 V_{S1}$ to V_R or V_{MO}/M_{MO} for commuter category airplanes instead of only the high speed requirement in the present rules. It is appropriate for commuter category airplanes to trim in the proposed range. It would not be burdensome because all present commuter category airplanes were designed to the proposed standard.

The proposed introductory paragraph of § 23.161(c) would delete the reference to V_{MO}/M_{MO} , since it is addressed in other

appropriate places. Proposed § 23.161(c)(1) would require trim at takeoff power, as this is a likely operational scenario for most airplanes and the condition should be tested. In addition, the proposed change would relate the maximum continuous power climb speeds and configuration to § 23.69, the enroute climb requirement. Current § 23.161(c)(2) moves to § 23.161(c)(4), changes the reference V_{REF} for a landing speed, and adds a requirement for the airplane to trim at the steepest landing approach gradient the applicant chooses under § 23.75. It is appropriate for the airplane to trim at all landing conditions. Current § 23.161(c)(3) moves to § 23.161(c)(2) with editorial changes. Current § 23.161(c)(4) moves to § 23.161(c)(3) with an increase in the trim speed from $0.9 V_{NO}$ or V_{NO} to V_{NO} or V_{NO}/M_{NO} . The increase in trim speed is appropriate because descent is permitted and is common at V_{NO} .

Proposed § 23.161(d) would make editorial changes in the introductory paragraph. It would reference the appropriate § 23.67 requirements and delete commuter category speed ranges, which are moved to the new § 23.161(e). Section 23.161(d)(4) is revised to specify flaps retracted instead of referencing the § 23.67 configurations. Flaps retracted is the likely sustained configuration where a pilot would need to trim. Also, the flaps retracted configuration for § 23.161(d)(4) would be consistent with the proposed § 23.67.

Proposed new § 23.161(e) would ensure that excessive forces are not encountered in commuter category airplanes during extended climbs at V_2 in the takeoff configuration, when climb above 400 feet is required.

Section 23.175 Demonstration of static longitudinal stability.

This proposal would make changes to § 23.175 power, configurations, and speeds.

Proposed § 23.175(a)(1) would change the flap position from the climb position to the flaps retracted position. This is a clarifying change since virtually all part 23 airplanes use flaps retracted for climb. Also, this proposed change would align the part 23 and part 25 climb static longitudinal stability requirements.

Proposed § 23.175(a)(3) would delete the option for the applicant to select some power other than maximum continuous power as an operating limitation. As noted in the proposed change to § 23.155, this would eliminate a power specification that is unnecessary and simplify normal operations for the pilot. Proposed § 23.175(a)(4) would make the trim speed consistent with the enroute all-engine climb speed.

The proposed change to § 23.175(b) would rearrange the section with no change in requirements. The definition of V_{rc}/M_{mc} contained in § 23.175(b)(2) is proposed to be moved to part 1, to harmonize with JAR 1. (See the proposed change to § 1.1.)

Current § 23.175(c), which requires the test for gear down cruise static longitudinal stability, would be deleted. This test is considered superfluous to the landing configuration

static longitudinal stability test and does not represent a likely operating scenario.

Proposed § 23.175(c) would be current § 23.175(d) with only a change to use V_{REF} as the trim speed.

Section 23.177 Static directional and lateral stability.

Proposed revisions to § 23.177 would delete the requirements for two-control airplanes, make minor clarifying changes, and specify an exclusion for acrobatic category airplanes.

Proposed § 23.177 would delete the introductory phrase concerning three-control airplanes, which is consistent with the deletion of the requirements for two-control airplanes in current paragraph (b). The two-control airplane regulations were introduced in 1945 but no two-control airplanes have been certificated for several decades and no need is foreseen for these regulations. If an applicant proposes a two-control airplane, the FAA would issue special conditions. After deleting the introductory portion of § 23.177(a), paragraph (a)(1) would be redesignated as (a). In the first sentence, the proposed change replaces "skid" with "wings level sideslip" to clarify the intended maneuver. Also, the proposed change increases the power requirement for demonstration of directional stability in the landing configuration. The current requirement specifies power necessary to maintain a three degree angle of descent. Maximum continuous power is considered appropriate since directional stability should be maintained during a balked landing, particularly since directional instability is an undesirable

characteristic at any point in the flight envelope. Also, V_A is replaced by V_0 to be consistent with § 23.1507.

Proposed § 23.177(b), currently (a)(2), replaces "any" with "all" in the first sentence to clarify that all landing gear and flap positions must be addressed. Also, the proposed paragraph would specify a minimum speed at which static lateral stability may not be negative, as $1.3 V_s$, for all configurations except takeoff. This is consistent with the other speeds specified in § 23.177(b) and relieves the requirement for other than takeoff speeds.

Proposed new § 23.177(c) would provide an exclusion for the dihedral effect for acrobatic category airplanes approved for inverted flight. The proposed change recognizes that, in fully acrobatic airplanes, the dihedral effect is not a desired characteristic.

The addition of proposed § 23.147(c), which ensures lateral control capability without the use of the primary lateral control system, compensates for the relieving nature of proposed § 23.177(b) and the exception from the requirements of § 23.177(b) for acrobatic category airplanes.

Present § 23.177(a)(3) is redesignated as § 23.177(d). The proposed § 23.177(d) deletes the next to the last sentence, concerning bank angle and heading, because the current requirement is not a necessary test condition and a constant heading during the sideslip may be impossible in some airplanes.

Present § 23.177(b) is deleted, as previously discussed, because it applies to two-control airplanes.

Section 23.201 Wings level stall.

This proposal would delete both two-control airplanes and altitude loss requirements and would make clarifying changes in § 23.201.

The proposed change to § 23.201(a) deletes the applicability reference for an airplane with independently controlled roll and directional controls. The last word, "pitches" is replaced by "stalls" since stalls may be defined by other than nose-down pitching.

Present § 23.201(b) is deleted since it applies to two-control airplanes. (See proposed change for § 23.177 for discussion of two-control airplane requirements.)

Current § 23.201(c) is divided into proposed § 23.201(b) and (c). Proposed § 23.201(b) covers stall recognition and proposed § 23.201(c) addresses stall recovery. Proposed § 23.201(b) clarifies that the test should start from a speed at least 10 knots above the stall speed. Proposed § 23.201(b) has no change in requirements. Section 23.201(c) is changed to specify how long the control must be held against the stop. This change would ensure that the procedure for determining stall speed is the same procedure used to test stall characteristics. The last sentence of current paragraph (c) on the increase of power is deleted because it would only apply to altitude loss.

Present § 23.201(d) would be deleted, as suggested by the JAA, since the determination of altitude loss, and its subsequent

furnishing in the AFM, is not considered information useful to the pilot for safe operation of the airplane.

Proposed § 23.201(d) would be based on present § 23.201(e) and would be revised to clarify that the roll and yaw limits apply during both entry and recovery.

Proposed § 23.201(e) is present paragraph (f) with some revisions. During FAR/JAR harmonization meetings, the JAA pointed out to the FAA that in high power-to-weight ratio airplanes, extreme nose-up attitudes were the principal criteria for use of reduced power, not the presence of undesirable stall characteristics. The FAA concurs and proposes to delete the phrase concerning stall characteristics.

Section 23.203 Turning flight and accelerated turning stalls.

Proposed § 23.203 would be revised by adding the word "turning" before "stalls" and after "accelerated" in the heading, the introductory text, and in proposed paragraphs (a)(2) and (b)(5). This proposed change clarifies that accelerated stalls are performed in turning flight. Also, it clarifies the definition to show that accelerated stalls are not intended to be performed in straight flight. This clarification reflects current certification practice.

Proposed § 23.203(a) and (b) would reference the stall definition in § 23.201(b), which is more specific than the present general words "when the stall has fully developed or the elevator has reached its stop."

For clarification, current paragraph (b)(4) would be separated into proposed paragraphs (b)(4) and (b)(5) without

substantive change, and current paragraph (b)(5) would be redesignated as paragraph (b)(6).

Proposed § 23.203(c)(1) would clarify the wing flap positions by changing "each intermediate position" to "each intermediate normal operating position."

The proposed change to § 23.203(c)(4) would clarify the use of reduced power. (See the proposed change to § 23.201(f).)

Proposed new paragraph (c)(6) has been added to be consistent with new § 23.207(c)(6) configurations (Amendment 23-45).

Section 23.205 Critical engine-inoperative stalls.

This proposal would delete § 23.205. The present requirement to demonstrate stalls with the critical engine inoperative is restricted to the enroute configuration and to a level of power asymmetry with which the airplane is controllable with wings level at the stalling speed. As a result, the power on the operating engines at the stall is normally fairly low, and neither the configuration nor the power setting represent the conditions most likely to accompany an inadvertent stall in service. Reduction of power of the operating engine(s) during the recovery is permitted, and it is questionable whether such action would be taken promptly in an inadvertent stall in service. Experience shows that stalls with significant power asymmetry can result in a spin, even on airplanes that are certificated to the present requirement. Apparently the requirement for demonstrating one-engine-inoperative stalls is not effective in ensuring that inadvertent stalls in service with

one engine inoperative will have satisfactory characteristics and be recoverable. Sufficient protection against the hazard of stalling with one engine inoperative is provided by the one-engine-inoperative performance requirements and operating speed margins, coupled with the requirements for determination of V_{MC} , the addition of a directional and lateral control test under § 23.147(b), and demonstration of stalling characteristics with symmetric power.

Section 23.207 Stall warning.

This proposal would delete the upper limit on stall speed margin and provide for mutable stall warning on acrobatic category airplanes in § 23.207.

Proposed § 23.207(c) would reference the stall tests required by § 23.201(b) and § 23.203(a)(1) and specify that during such tests for one knot per second deceleration stalls, both wings level and turning, the stall warning must begin at a speed exceeding the stalling speed by a margin of not less than 5 knots. The quantified upper limit in the current rule of 10 knots or 15 percent of the stalling speed would be deleted. The upper limit has created problems for manufacturers because of the complex design features required to show compliance. The upper limit requirement was in effect replaced by the nuisance stall warning requirement in § 23.207(d).

Present § 23.207(d) would be divided and moved to proposed § 23.207(d) and (e). Proposed § 23.207(d) on nuisance stall warnings would have no change in requirements. Proposed § 23.207(e) would delete the bottom limit of five knots for

decelerations greater than one knot per second. Also, it would specify that the stall warning must begin sufficiently before the stall so that the pilot can take corrective action. This is considered appropriate because, at the higher deceleration rates of three to five knots per second, a specified five knots may not be enough stall warning.

Proposed new § 23.207(f) allows for a mutable stall warning system for acrobatic category airplanes, with automatic arming for takeoff and rearming for landing. This feature is useful for acrobatic pilots and provides safeguards for takeoff and landing.

Section 23.221 Spinning.

This proposal would revise the point to start the one-turn-spin recovery count, delete the "characteristically incapable of spinning" option, and make minor changes in acrobatic category spins in § 23.221.

Proposed § 23.221(a) would replace the exception for airplanes characteristically incapable of spinning with an exception for airplanes that demonstrate compliance with the optional spin resistant requirements of paragraph (a)(2) of this section. Criteria for an airplane incapable of spinning are unnecessary since criteria for spin resistant airplanes are provided. Proposed § 23.221(a) would change the point at which the count for the one-turn-spin recovery begins. The change would specify a more specific point to begin the count by replacing the current phrase "after the controls have been applied" with "after initiation of the first control action for recovery." Under the present rules, if an applicant proposes a

multiple step recovery procedure that starts with the rudder, then the airplane may be effectively recovered before the start of the recovery count.

Proposed § 23.221(a)(1)(ii) would specify that no control force or characteristic can adversely affect prompt recovery. This would be an improvement over the present prohibition of excessive back pressure in current § 23.221(a)(1)(ii).

Present § 23.221(a)(1) is proposed to be recodified into § 23.221(a)(1)(i) through (a)(1)(iv) with no changes in the requirements. Present § 23.221(a)(2) on spin resistant airplanes would be restated with minor editorial changes but with no change in requirements.

Proposed § 23.221(b) would specify the emergency egress requirements of § 23.807(b)(5) for those utility category airplanes approved for spinning. This is considered an appropriate way to cross-reference the requirements of § 23.807 to the flight requirements.

The proposed § 23.221(c) introductory paragraph would require acrobatic category airplanes to meet the one-turn-spin requirements of § 23.221(a). This change is proposed because acrobatic category airplanes should have sufficient controllability to recover from the developing one-turn-spin under the same conditions as normal category airplanes. The proposed introductory paragraph would also cross-reference § 23.807 for emergency egress requirements.

Proposed § 23.221(c) pertaining to acrobatic category airplanes would add a requirement in proposed paragraph (c)(1)

for spin recovery after six turns or any greater number of turns for which certification is requested. The proposed rule would require recovery within 1.5 turns after initiation of the first control action for recovery. This proposed requirement would ensure recovery within 1.5 turns if the spin mode changes beyond six turns. As an alternative, the applicant may stop at six turns and provide a limitation of six turns.

Proposed § 23.221(c)(2) would delete the option to retract flaps during recovery and would provide the applicant with a choice of flaps up or flaps deployed for spin approval. The paragraph would continue to prohibit exceeding applicable airspeed limits and limit maneuvering load factors.

A new § 23.221(c)(4) is proposed to ensure that the acrobatic spins do not cause pilot incapacitation.

The present § 23.221(d) is proposed to be deleted. The recognition of airplanes that are "characteristically incapable of spinning" has been in the regulation since at least 1937. In 1942, the present weight, center of gravity, and control mis-rig criteria were introduced into Civil Air Regulation (CAR) 03. Since then, the National Aeronautics and Space Administration (NASA) spin resistant requirements, which are based on research, have been developed and incorporated in the regulations by amendment 23-42 (56 FR 344, January 3, 1991). If an applicant proposes a non-spinable airplane, it would be appropriate to apply the more technologically advanced requirements of proposed § 23.221(a)(2); therefore, § 23.221(d) would be deleted.

Section 23.233 Directional stability and control.

This proposal would make minor word changes to § 23.233(a) to harmonize this section with the corresponding JAR section.

Section 23.235 Operation on unpaved surfaces.

This proposal would revise the heading of § 23.235 and delete water operating requirements, which are moved to proposed new § 23.237.

Section 23.237 Operation on water.

Proposed new § 23.237, for operation on water, is essentially the same as the current § 23.235(b).

Section 23.253 High speed characteristics.

This proposal would delete the current paragraph (b)(1), since the requirement for piloting strength and skill is covered in § 23.141.

Section 23.562 Emergency landing dynamic conditions.

This proposal would change the one engine inoperative climb reference in § 23.562(d) to § 23.67(a)(1).

Section 23.1323 Airspeed indicating system.

This proposal would delete the AFM requirements from § 23.1323, which are in current paragraph (d)(1) and are proposed to be redesignated in the systems NPRM as paragraph (f).

Removing § 23.1323(f) would delete from this section the requirement to show airspeed system calibration information since this requirement would be covered in proposed § 23.1587 in this NPRM.

Section 23.1325 Static pressure system.

This proposal would revise § 23.1325(e) to clarify that the calibration must be conducted in flight, which is standard certification practice. Section 23.1325(f) would be deleted because the results of the calibration would be required in the proposed § 23.1587.

Section 23.1511 Flap extended speed.

This proposal would delete from § 23.1511(a) references to § 23.457 because § 23.457 is proposed to be deleted from the FAR in a related NPRM on airframes.

Section 23.1521 Powerplant limitations.

This proposal would require, under § 23.1521, maximum temperature to be established for takeoff operation and would require an ambient temperature limit for reciprocating engines in airplanes of more than 6,000 pounds.

Proposed § 23.1521(b)(5) would require the establishment of maximum cylinder head, liquid coolant, and oil temperature limits for takeoff operation without regard to the allowable time. Presently, temperature limits are required only if the takeoff power operation is permitted for more than two minutes. It is appropriate to require operating temperature limitations because most takeoff operations will exceed two minutes.

Proposed § 23.1521(e) would require an ambient temperature limit for turbine engine-powered airplanes and reciprocating engine-powered airplanes over 6,000 pounds. This change is

proposed because these airplanes are subject to WAT limits and it will ensure that airplane engines will cool at the ambient temperature limit.

Section 23.1543 Instrument markings: General.

Proposed new § 23.1543(c) would require that all related instruments be calibrated in compatible units. This is considered essential for safe operation.

Section 23.1545 Airspeed indicator.

Proposed revisions to § 23.1545 would differentiate between WAT limited and non-WAT limited airplanes in § 23.1545.

Proposed § 23.1545(b)(5) would delete any one-engine-inoperative best rate of climb speed marking requirements for WAT limited airplanes. These airplanes would already have scheduled speeds in case of an engine failure. Proposed paragraph (b)(5) would apply only to non-WAT airplanes for which the one-engine-inoperative best rate of climb speed marking has been simplified to sea level at maximum weight. Since the blue arc rule was promulgated in amendment 23-23 (43 FR 50593, October 30, 1978), certification experience has shown that the marking of an arc is unnecessarily complicated. For many airplanes, the arc was so narrow that the arc was a line. Therefore, proposed paragraph (b)(5) would require a blue radial line instead of an arc.

Proposed § 23.1545(b)(6) would retain the same V_{nc} requirement for non-WAT airplanes and delete any V_{nc} markings for WAT airplanes since WAT airplanes already have scheduled speeds in case of engine failure.

Section 23.1553 Fuel quantity indicator.

This proposal would delete, from § 23.1553, the use of an arc to show a quantity of unusable fuel. The proposed rule references the unusable fuel determination and requires only a red radial line, which would provide a clearer indication of fuel quantity for pilots.

Section 23.1555 Control markings.

This proposal would add to § 23.1555(e)(2) the requirement that no other control be red. This would help prevent use of a wrong control in an emergency.

Section 23.1559 Operating limitations placard.

This proposal would simplify the present § 23.1559 and delete duplicate material.

Proposed § 23.1559(a), (b), and a new paragraph (c), would provide essentially the same information as the current rule. All airplanes currently operate with an AFM and the new rule places emphasis on using the AFM to define required operating limitations.

Section 23.1563 Airspeed placards.

This proposal would add a new paragraph (c) to § 23.1563. The new paragraph would be applicable to WAT limited airplanes and would require providing the maximum V_{MC} in the takeoff configuration determined under § 23.149(b). This is desirable since the V_{MC} is not marked on the airspeed indicator for these airplanes.

Section 23.1567 Flight maneuver placard.

Proposed new § 23.1567(d), which would be applicable to acrobatic and utility airplanes approved for intentional spinning, would require a placard listing control actions for recovery. Also, it would require a statement on the placard that the airplane be recovered when spiral characteristics occur, or after six turns, or at any greater number of turns for which certification tests have been conducted. This paragraph would replace the similar placard requirement in current § 23.1583(e)(3) for acrobatic category airplanes, and the placard requirement would be deleted from § 23.1583(e).

Section 23.1581 General.

This proposal would make editorial changes in § 23.1581 and would recognize WAT limited and non-WAT limited airplanes.

Proposed new § 23.1581(a)(3) would require information necessary to comply with relevant operating rules. This is a FAR/JAR harmonization item and is considered necessary because some operational rules, such as § 135.391, require flight planning with one-engine-inoperative cruise speed and/or driftdown data. For United States part 135 airplanes, it represents no change in requirements.

Proposed § 23.1581(b)(2) would require that only WAT limited airplane AFM's provide data necessary for determining WAT limits.

Proposed new § 23.1581(c) would require the AFM units to be the same as on the instruments. This requirement would enhance operational safety.

Proposed § 23.1581(d) would delete the current requirement for a table of contents. This is considered to be a format requirement and not appropriate for this section, which specifies AFM content. Current § 23.1581(d) is being replaced by a requirement to present all operational airspeeds as indicated airspeeds. Although not currently required, this is current certification practice.

Section 23.1583 Operating limitations.

Proposed revisions to § 23.1583 would make minor changes in the operating limitations information furnished in the AFM. These proposed changes include revising airspeed limitations for commuter category airplanes, requiring AFM limitations for WAT limited airplanes, furnishing ambient temperature limitations, furnishing smoking restriction information, and furnishing information specifying types of runway surfaces.

Proposed § 23.1583(a)(3) would make the V_{MO}/M_{MO} airspeed operating limitations applicable only to turbine powered commuter category airplanes. This is consistent with current practice since no reciprocating engine-powered commuter category airplanes have been proposed.

Proposed § 23.1583(c)(3) would add takeoff and landing weight limitations for WAT limited airplanes. (See the § 23.45 proposal for discussion of WAT limited airplanes.)

Proposed § 23.1583(c)(4) and (5) renumber the present § 23.1583(c)(3) and (4). These proposed paragraphs are revised editorially and cross-references are updated. Proposed paragraph (c)(4)(ii) would impose a new requirement that the AFM include

the maximum takeoff weight for each airport altitude and ambient temperature within the range selected by the applicant at which the accelerate-stop distance determined under § 23.55 is equal to the available runway length plus the length of any stopway, if available. This is currently required for transport category airplanes and is necessary for harmonization with the JAR.

Proposed new § 23.1583(c)(6) would establish the zero wing fuel weight of § 23.343 as a limitation. This would provide the pilot with information necessary to prevent exceeding airplane structural limits.

Proposed § 23.1583(d) has editorial changes only.

Proposed § 23.1583(e)(1) and (2) would delete references to "characteristically incapable of spinning." As discussed under § 23.221, requirements for "characteristically incapable of spinning" would be deleted.

Proposed § 23.1583(e)(3) and (4) would replace present paragraph (e)(3). Proposed § 23.1583(e)(4) would add the requirement for specifying limitations associated with spirals, six turn spins, or more than six turn spins. The requirement for a placard has been deleted since the requirement would be covered in § 23.1567.

Proposed § 23.1583(e)(5) would be based on current paragraph (e)(4) for commuter category airplanes. It would be revised to define the maneuvers as those proposed for commuter category airplanes in § 23.3.

Proposed § 23.1583(f) would revise the heading of the paragraph and add the limit negative load factor for acrobatic

category airplanes. The limit negative load factor is essential for safe operational use.

Proposed § 23.1583(g) would make editorial changes with no change in requirements. The paragraph would reference the requirements of flight crews in § 23.1523.

Proposed § 23.1583(i), (j) and (k) are the current § 23.1583(k), (l) and (m), as redesignated.

Proposed new § 23.1583(l) would require furnishing baggage and cargo loading limits.

Proposed new § 23.1583(m) would require furnishing any special limitations on systems and equipment. This would provide the pilot with information necessary for safe operation of the airplane systems and equipment.

Proposed new § 23.1583(n) would require a statement on ambient temperature limitations. Maximum cooling temperature limits have been required for turbine powered airplanes by § 23.1521(e); however, the requirement for the limitation has never been specified in § 23.1583. Proposed § 23.1583(n) would require furnishing both maximum and minimum temperature limits if appropriate. A minimum temperature limit would provide the pilot with information necessary to avoid airplane damage during low temperature operations.

Proposed new § 23.1583(o) would require furnishing any occupant smoking limitations on the airplane. This would enhance safe operation of the airplane.

Proposed new § 23.1583(p) would require the applicant to state what runway surfaces have been approved. This provides the

pilot with a positive indication of which runway types may be used.

Section 23.1585 Operating procedures.

This proposal would rearrange the current material in § 23.1585 and add additional requirements as discussed below.

Proposed § 23.1585(a) would contain the requirements applicable to all airplanes. The requirements would be arranged in a different order from the current requirements in paragraph (a). The requirements for information that must be included cover -- unusual flight or ground handling characteristics; maximum demonstrated values of crosswinds; recommended speed for flight in rough air; restarting an engine in flight; and making a normal approach and landing in accordance with § 23.73 and § 23.75. All of these requirements are in current § 23.1585(a) except for restarting a turbine engine in flight, which is in current paragraph (c)(5) pertaining only to multiengine airplanes. The FAA decided that a restart capability is not required for single reciprocating engine airplanes for the reasons given in the preamble discussion of proposal 3 in amendment 23-43 (58 FR 18958, April 9, 1993). The requirement for providing restart information should apply to single turbine engines, since turbine engine designs incorporate a restart capability and inadvertent shutdowns may occur. Normal approach and landing information in accordance with the landing requirement in proposed § 23.73 and § 23.75 is new. This is

necessary to enable pilots to achieve the published landing distances and, if necessary, to safely transition to a balked landing.

Proposed § 23.1585(b) would be a revision of § 23.1585(b) on gliding after an engine failure for single-engine airplanes. The proposed version would reference requirements in proposed § 23.71.

Proposed § 23.1585(c) for multiengine airplanes would require compliance with (a) plus the following information requirements from current paragraph (c): approach and landing with an engine inoperative; balked landing with an engine inoperative; and V_{SE} as determined in § 23.149. Current paragraph (c) requirements for information on procedures for continuing a takeoff following an engine failure and continuing a climb following an engine failure would be moved to proposed (e) for normal, utility, and acrobatic multiengines.

Proposed § 23.1585(d) would apply to normal, utility and acrobatic airplanes. These airplanes would have to comply with paragraph (a) and either (b) or (c). These airplanes would also have to comply with the normal takeoff, climb, and the abandoning a takeoff procedures, which are currently contained in paragraph (a).

As discussed above, § 23.1585(c), for normal, utility and acrobatic multiengine airplanes, would require compliance with proposed (a), (c), and (d) plus requirements for continuing a takeoff or climb with one engine inoperative, which are now in current paragraph (c)(1) and (2).

Proposed § 23.1585(f) would require commuter category airplanes to comply with paragraphs (a) and (c) plus the normal takeoff requirements from current paragraph (a)(2) revised; accelerate-stop requirements, which are new, and continuing takeoff after engine failure, which are in current paragraph (c)(1).

Proposed § 23.1585(g) would be the same as current paragraph (d) on identifying operating conditions, which necessitate fuel system independence.

Proposed § 23.1585(h) would be the same as current paragraph (e) for disconnecting the battery from its charging source.

Proposed § 23.1585(i) is based on current paragraph (g) on the total quantity of usable fuel and adds information on the effect of pump failure on unusable fuel.

Proposed new § 23.1585(j) would require procedures for safe operation of the airplanes' systems and equipment. Although not currently required, this is current industry practice.

Present § 23.1585(h), commuter category airplane procedures for restarting turbine engines in flight, would no longer be necessary because the requirement would be covered under paragraph (a)(4).

Section 23.1587 Performance information.

Proposed § 23.1587 would rearrange existing material, delete ski plane performance exceptions, delete the option of calculating approximate performance, delete stall altitude loss data, and require overweight landing performance in § 23.1587.

Stalling speed requirements of current paragraph (c)(2) and (3) would be combined and moved to paragraph (a)(1) and would reference the stalling speed requirement of § 23.49. Information on the steady rate and gradient of climb with all engines operating would be required by proposed paragraph (a)(2). This is revised from current paragraph (a)(2). The reference would be changed to proposed § 23.69(a).

Proposed (a)(3) would require, as is now required, that landing distance be determined under § 23.75, and would add that this must be provided for each airport altitude, standard temperature, and type of surface for which it is valid. Proposed paragraph (a)(4) would require information on the effect on landing distance when landing on other than hard surface, as determined under § 23.45(g). Proposed paragraph (a)(5) would cover information on the effects on landing distance of runway slope and wind. This would provide the pilot with data with which to account for these factors in his or her takeoff calculations.

Current requirements in § 23.1587(b) on ski planes would be deleted. Proposed paragraph (b) would add a steady angle of climb/descent requirement as determined under § 23.77(a). This requirement would apply to all non-WAT airplanes.

Proposed paragraph (c) would apply to normal, utility, and acrobatic category airplanes, rather than all airplanes as in current paragraph (c). The proposed (c) would delete stall altitude loss requirements that are in current paragraph (c)(1). As mentioned, current stalling speed requirements would be moved

to proposed paragraph (a)(1). Current paragraph (c)(4) on cooling climb speed data would also be deleted since all airplanes would cool at scheduled speeds.

Proposed paragraph (c)(1) would pertain to the takeoff distance determined under § 23.53 and the type of surface. Proposed paragraphs (c)(2) and (c)(3) pertain to the effect on takeoff distance of the runway surface, slope, and headwind and tailwind component.

Proposed paragraph (c)(4) would impose a new requirement pertaining to the one-engine inoperative takeoff climb/descent performance for WAT-limited airplanes. This pertains only to reciprocating engine-powered airplanes. It would provide the pilot with the information determined under proposed § 23.66.

Proposed paragraph (c)(5) pertains to enroute rate and gradient of climb/descent determined under § 23.69(b), for multiengine airplanes.

Proposed § 23.1587(d) for commuter category airplanes would incorporate the present data plus the addition of accelerate-stop data, overweight landing performance, and the effect of operation on other than smooth hard surfaces.

Section 23.1589 Loading information.

Proposed § 23.1589(b) would make editorial changes to simplify the text, with no change in requirements.

Appendix E.

Appendix E would be deleted for the reasons given in the proposed change to § 23.25.

Preliminary Regulatory Evaluation, Initial Regulatory Flexibility Determination, and Trade Impact Assessment

Proposed changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Office of Management and Budget directs agencies to assess the effects of regulatory changes on international trade. In conducting these analyses, the FAA has determined that this rule: (1) would generate benefits that justify its costs and is not a "significant regulatory action" as defined in the Executive Order; (2) is not significant as defined as DOT's Policies and Procedures; (3) would not have a significant impact on a substantial number of small entities; and (4) would not constitute a barrier to international trade. These analyses, available in the docket, are summarized below.

Regulatory Evaluation Summary

Of the 57 sections that would be amended or added in this proposed rule, the FAA has identified 15 that could result in additional compliance costs to one or more airplane categories. Amendments to five sections could result in cost savings. The greatest costs would be incurred by manufacturers of WAT limited airplanes (e.g., multiengine airplanes with maximum weights of

more than 6,000 pounds). When amortized over a production run, the quantified incremental costs would be relatively modest--less than \$100 per airplane. The FAA solicits comments concerning the incremental certification/development costs attributable to the proposed rule.

The primary benefit of the proposed rule would be the cost efficiencies of harmonization with the JAR for those manufacturers that choose to market airplanes in JAA countries as well as to manufacturers in JAA countries that choose to market airplanes in the U.S. Other benefits of the proposed rule would be decreased reliance on special conditions, simplification of the certification process through clarification of existing requirements, and increased flexibility through optional designs.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress to ensure that small entities are not unnecessarily and disproportionately burdened by Federal regulations. The RFA requires a Regulatory Flexibility Analysis if a proposed rule would have a significant economic impact, either detrimental or beneficial, on a substantial number of small entities. Based on FAA Order 2100.14A, Regulatory Flexibility Criteria and Guidance, the FAA has determined that the proposed amendments would not have a significant economic impact on a substantial number of small entities.

International Trade Impact Assessment

The proposed rule would not constitute a barrier to international trade, including the export of American airplanes to foreign countries and the import of foreign airplanes into the United States. Instead, the proposed flight certification procedures have been harmonized with those of the JAA and would lessen restraints on trade.

Federalism Implications

The regulations proposed herein would not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. Therefore, in accordance with Executive Order 12612, it is determined that this proposal would not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

Conclusion

The FAA proposes to revise the flight airworthiness standards for normal, utility, acrobatic, and commuter category airplanes with the same standards that will be proposed for the same category airplanes by the Joint Airworthiness Authority in Europe. If adopted, the proposed revision would reduce the regulatory burden on the United States and European airplane manufacturers by relieving them of the need to show compliance

with different standards each time they seek certification approval of an airplane in a different country.

For the reasons discussed in the preamble, and based on the findings in the Regulatory Evaluation, the FAA has determined that this proposed regulation is not a significant regulatory action. In addition, the FAA certifies that this proposal, if adopted, will not have a significant economic impact on a substantial number of small entities under the criteria of the Regulatory Flexibility Act. This proposal is not considered significant under DOT Regulatory Policies and Procedures (44 FR 11034, February 26, 1979). An initial regulatory evaluation of the proposal has been placed in the docket. A copy may be obtained by contacting the person identified under "FOR FURTHER INFORMATION CONTACT."

List of Subjects in 14 CFR Part 1

Air transportation.

List of Subjects in 14 CFR Part 23

Aircraft, Aviation safety, Signs and symbols.

The Proposed Amendment

In consideration of the foregoing, the Federal Aviation Administration proposes to amend parts 1 and 23 of the Federal Aviation Regulations (14 CFR parts 1 and 23) as follows:

PART 1--DEFINITIONS AND ABBREVIATIONS

1. The authority citation for part 1 continues to read as follows:

Authority: 49 U.S.C. app. 1347, 1348, 1354(a), 1357(d)(2), 1372, 1421 through 1430, 1432, 1442, 1443, 1472, 1510, 1522, 1652(e), 1655(c), 1657(f); 49 U.S.C. 106(g).

2. A new definition is added to § 1.1 to read as follows:
§ 1.1 General definitions.

* * * * *

Maximum speed for stability characteristics. V_{rc}/M_{rc} means a speed that may not be less than a speed midway between maximum operating limit speed (V_{mo}/M_{mo}) and demonstrated flight diving speed (V_{df}/M_{df}), except that, for altitudes where the Mach number is the limiting factor, M_{rc} need not exceed the Mach number at which effective speed warning occurs.

* * * * *

**PART 23--AIRWORTHINESS STANDARDS: NORMAL, UTILITY, ACROBATIC,
AND COMMUTER CATEGORY AIRPLANES**

3. The authority citation for part 23 continues to read as follows:

Authority: 49 U.S.C. app. 1344, 1354(a), 1355, 1421, 1423, 1425, 1428, 1429, 1430, 49 U.S.C. 106(g).

4. Section 23.3 is amended by revising paragraphs (b)(2, (d), and (e) to read as follows:

§ 23.3 Airplane categories.

* * * * *

(b) * * *

(1) * * *

(2) Lazy eights, chandelles, and steep turns, or similar maneuvers, in which the angle of bank is more than 60 degrees but not more than 90 degrees.

(3) * * *

* * * * *

(d) The commuter category is limited to propeller-driven, multiengine airplanes that have a seating configuration, excluding pilot seats, or 19 or less, and a maximum certificated takeoff weight of 19,000 pounds or less. The commuter category operation is limited to any maneuver incident to normal flying, stalls (except whip stalls) and steep turns, in which the angle of bank is not more than 60 degrees.

(e) Except for commuter category, airplanes may be type certificated in more than one category if the requirements of each requested category are met.

5. Section 23.25 is amended by revising paragraphs (a)(1)(i) and (a)(1)(iii) to read as follows:

§ 23.25 Weight limits.

(a) Maximum weight. The maximum weight is the highest weight at which compliance with each applicable requirement of this part (other than those complied with at the design landing weight) is shown. The maximum weight must be established so that it is--

(1) Not more than the least of--

(i) The highest weight selected by the applicant; or

(ii) * * *

(iii) The highest weight at which compliance with each applicable flight requirement is shown, and

* * * * *

6. Section 23.33 is amended by revising paragraphs (b)(1) and (2) to read as follows:

§ 23.33 Propeller speed and pitch limits.

(b) * * *

(1) During takeoff and initial climb at the all engine(s) operating climb speed specified in § 23.65, the propeller must limit the engine r.p.m., at full throttle or at maximum allowable

takeoff manifold pressure, to a speed not greater than the maximum allowable takeoff r.p.m.; and

(2) During a closed throttle glide, at V_{NE} , the propeller may not cause an engine speed above 110 percent of maximum continuous speed.

* * * * *

7. Section 23.45 is revised to read as follows:

§ 23.45 General.

(a) Unless otherwise prescribed, the performance requirements of this part must be met for--

(1) Still air and standard atmosphere; and

(2) Ambient atmospheric conditions, for commuter category airplanes, for reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight, and for turbine engine-powered airplanes.

(b) Performance data must be determined over not less than the following ranges of conditions--

(1) Airport altitudes from sea level to 10,000 feet; and

(2) For reciprocating engine-powered airplanes of 6,000 pounds, or less, maximum weight, temperature from standard to 30°C above standard; or

(3) For reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight and turbine engine-powered airplanes, temperature from standard to 30°C above standard, or the maximum ambient atmospheric temperature at which compliance with the cooling provisions of § 23.1041 to § 23.1047 is shown, if lower.

(c) Performance data must be determined with the cowl flaps or other means for controlling the engine cooling air supply in the position used in the cooling tests required by § 23.1041 to § 23.1047.

(d) The available propulsive thrust must correspond to engine power, not exceeding the approved power, less--

(1) Installation losses; and

(2) The power absorbed by the accessories and services appropriate to the particular ambient atmospheric conditions and the particular flight condition.

(e) The performance, as affected by engine power, must be based on a relative humidity of--

(1) 80 percent, at and below standard temperature; and

(2) 34 percent, at and above standard temperature plus 50°F.

Between the two temperatures, the relative humidity must vary linearly.

(f) Unless otherwise prescribed in determining the takeoff and landing distances, changes in the airplane's configuration, speed, and power must be made in accordance with procedures established by the applicant for operation in service. These procedures must be able to be executed consistently by pilots of average skill in atmospheric conditions reasonably expected to be encountered in service.

(g) The following, as applicable, must be determined on a smooth, dry, hard-surfaced runway--

(1) Takeoff distance of § 23.53(b);

- (2) Accelerate-stop distance of § 23.55;
- (3) Takeoff distance and takeoff run of § 23.59; and
- (4) Landing distance of § 23.75.

The effect on these distances of operation on other types of surfaces (for example, grass, gravel) when dry, may be determined or derived and these surfaces listed in the Airplane Flight Manual in accordance with § 23.1583(p).

(h) For commuter category airplanes, the following also apply:

(1) Unless otherwise prescribed, the applicant must select the takeoff, enroute, approach, and landing configurations for the airplane.

(2) The airplane configuration may vary with weight, altitude, and temperature, to the extent that they are compatible with the operating procedures required by paragraph (h)(3) of this section.

(3) Unless otherwise prescribed, in determining the critical-engine-inoperative takeoff performance, takeoff flight path, and accelerate-stop distance, changes in the airplane's configuration, speed, and power must be made in accordance with procedures established by the applicant for operation in service.

(4) Procedures for the execution of discontinued approaches and balked landings associated with the conditions prescribed in § 23.67(c)(4) and § 23.77(c) must be established.

(5) The procedures established under paragraphs (h)(3) and (h)(4) of this section must--

(i) Be able to be consistently executed by a crew of average skill in atmospheric conditions reasonably expected to be encountered in service;

(ii) Use methods or devices that are safe and reliable; and

(iii) Include allowances for any reasonably expected time delays in the execution of the procedures.

8. Section 23.49 is revised to read as follows:

§ 23.49 Stalling speed.

(a) V_{so} and V_{s1} are the stalling speeds or the minimum steady flight speeds, in knots (CAS), at which the airplane is controllable with--

(1) For reciprocating engine-powered airplanes, the engine(s) idling, the throttle(s) closed or at not more than the power necessary for zero thrust at a speed not more than 110 percent of the stalling speed;

(2) For turbine engine-powered airplanes, the propulsive thrust not greater than zero at the stalling speed, or, if the resultant thrust has no appreciable effect on the stalling speed, with engine(s) idling and throttle(s) closed;

(3) The propeller(s) in the takeoff position;

(4) The airplane in the condition existing in the test, in which V_{so} and V_{s1} are being used;

(5) The center of gravity in the position that results in the highest value of V_{so} and V_{s1} ; and

(6) The weight used when V_{so} or V_{s1} are being used as a factor to determine compliance with a required performance standard.

(b) V_{so} and V_{s1} must be determined by flight tests, using the procedure and meeting the flight characteristics specified in § 23.201.

(c) Except as provided in paragraph (d) of this section, V_{so} at maximum weight must not exceed 61 knots for--

(1) Single-engine airplanes; and

(2) Multiengine airplanes of 6,000 pounds or less maximum weight that cannot meet the minimum rate of climb specified in § 23.67(a)(1) with the critical engine inoperative.

(d) All single-engine airplanes, and those multiengine airplanes of 6,000 pounds or less maximum weight with a V_{so} of more than 61 knots that do not meet the requirements of § 23.67(a)(1), must comply with § 23.562(d).

9. Section 23.51 is revised to read as follows:

§ 23.51 Takeoff speeds.

(a) For normal, utility, and acrobatic category airplanes, rotation speed, V_r , is the speed at which the pilot makes a control input, with the intention of lifting the airplane out of contact with the runway or water surface.

(1) For multiengine landplanes, V_r must not be less than the greater of $1.05 V_{mc}$ or $1.10 V_{s1}$;

(2) For single-engine landplanes, V_r , must not be less than V_{s1} ; and

(3) For seaplanes and amphibians taking off from water, V_R , may be any speed that is shown to be safe under all reasonably expected conditions, including turbulence and complete failure of the critical engine.

(b) For normal, utility, and acrobatic category airplanes, the speed at 50 feet above the takeoff surface level must not be less than:

(1) For multiengine airplanes, the highest of--

(i) A speed that is shown to be safe for continued flight (or emergency landing, if applicable) under all reasonably expected conditions, including turbulence and complete failure of the critical engine;

(ii) $1.10 V_{MC}$; or

(iii) $1.20 V_{S1}$.

(2) For single-engine airplanes, the higher of--

(i) A speed that is shown to be safe under all reasonably expected conditions, including turbulence and complete engine failure; or

(ii) $1.20 V_{S1}$.

(c) For commuter category airplanes, the following apply:

(1) V_1 must be established in relation to V_{EF} as follows:

(i) V_{EF} is the calibrated airspeed at which the critical engine is assumed to fail. V_{EF} must be selected by the applicant but must not be less than $1.05 V_{MC}$ determined under § 23.149(b) or, at the option of the applicant, not less than V_{MCG} determined under § 23.149(f).

(ii) The takeoff decision speed, V_1 , is the calibrated airspeed on the ground at which, as a result of engine failure or other reasons, the pilot is assumed to have made a decision to continue or discontinue the takeoff. The takeoff decision speed, V_1 , must be selected by the applicant but must not be less than V_{cr} plus the speed gained with the critical engine inoperative during the time interval between the instant at which the critical engine is failed and the instant at which the pilot recognizes and reacts to the engine failure, as indicated by the pilot's application of the first retarding means during the accelerate-stop determination of § 23.55.

(2) The rotation speed, V_R , in terms of calibrated airspeed, must be selected by the applicant and must not be less than the greatest of the following:

- (i) V_1 ;
- (ii) $1.05 V_{MC}$ determined under § 23.149(b);
- (iii) $1.10 V_{S1}$; or
- (iv) The speed that allows attaining the initial climb-out speed, V_2 , before reaching a height of 35 feet above the takeoff surface in accordance with § 23.57(c)(2).

(3) For any given set of conditions, such as weight, altitude, temperature, and configuration, a single value of V_R must be used to show compliance with both the one-engine-inoperative takeoff and all-engines-operating takeoff requirements.

(4) The takeoff safety speed, V_2 , in terms of calibrated airspeed, must be selected by the applicant so as to allow the

gradient of climb required in § 23.67(c)(1) and (c)(2) but must not be less than $1.10 V_{MC}$ or less than $1.20 V_{S1}$.

(5) The one-engine-inoperative takeoff distance, using a normal rotation rate at a speed 5 knots less than V_R , established in accordance with paragraph (c)(2) of this section, must be shown not to exceed the corresponding one-engine-inoperative takeoff distance, determined in accordance with § 23.57 and § 23.59(a)(1), using the established V_R . The takeoff, otherwise performed in accordance with § 23.57, must be continued safely from the point at which the airplane is 35 feet above the takeoff surface and at a speed not less than the established V_2 minus 5 knots.

(6) The applicant must show, with all engines operating, that marked increases in the scheduled takeoff distances, determined in accordance with § 23.59(a)(2), do not result from over-rotation of the airplane or out-of-trim conditions.

10. Section 23.53 is revised to read as follows:

§ 23.53 Takeoff performance.

(a) For normal, utility, and acrobatic category airplanes, the takeoff distance must be determined in accordance with paragraph (b), using speeds determined in accordance with § 23.51(a) and (b).

(b) For normal, utility, and acrobatic category airplanes, the distance required to takeoff and climb to a height of 50 feet above the takeoff surface must be determined for each weight,

altitude, and temperature within the operational limits established for takeoff with--

- (1) Takeoff power on each engine;
- (2) Wing flaps in the takeoff position(s); and
- (3) Landing gear extended.

(c) For commuter category airplanes, takeoff performance, as required by §§ 23.55 through 23.59, must be determined with the operating engine(s) within approved operating limitations.

11. Section 23.55 is amended by revising paragraph (a) and the introductory text of paragraph (b) to read as follows:

§ 23.55 Accelerate-stop distance.

* * * * *

(a) The accelerate-stop distance is the sum of the distances necessary to--

(1) Accelerate the airplane from a standing start to V_{EF} with all engines operating;

(2) Accelerate the airplane from V_{EF} to V_1 , assuming the critical engine fails at V_{EF} ; and

(3) Come to a full stop from the point at which V_1 is reached.

(b) Means other than wheel brakes may be used to determine the accelerate-stop distances if that means--

(1) * * *

(2) * * *

12. Section 23.57 is amended by revising the introductory text of paragraph (a), paragraph (b), paragraph (c)(1), the introductory text of paragraph (c)(3), paragraph (c)(4), and paragraph (d); and by adding a new paragraph (e) to read as follows:

§ 23.57 Takeoff path.

* * * *

(a) The takeoff path extends from a standing start to a point in the takeoff at which the airplane is 1500 feet above the takeoff surface at or below which height the transition from the takeoff to the enroute configuration must be completed; and

* * * *

(b) During the acceleration to speed V_2 , the nose gear may be raised off the ground at a speed not less than V_R . However, landing gear retraction must not be initiated until the airplane is airborne.

(c) * * *

(1) The slope of the airborne part of the takeoff path must not be negative at any point;

* * * *

(3) At each point along the takeoff path, starting at the point at which the airplane reaches 400 feet above the takeoff surface, the available gradient of climb must not be less than--

* * * *

(4) Except for gear retraction and automatic propeller feathering, the airplane configuration must not be changed, and

no change in power that requires action by the pilot may be made, until the airplane is 400 feet above the takeoff surface.

(d) The takeoff path to 35 feet above the takeoff surface must be determined by a continuous demonstrated takeoff.

(e) The takeoff flight path from 35 feet above the takeoff surface must be determined by synthesis from segments; and

(1) The segments must be clearly defined and must be related to distinct changes in configuration, power, and speed;

(2) The weight of the airplane, the configuration, and the power must be assumed constant throughout each segment and must correspond to the most critical condition prevailing in the segment; and

(3) The takeoff flight path must be based on the airplane's performance without ground effect.

13. Section 23.59 is amended by revising the introductory paragraph, paragraph (a)(2), and paragraph (b) to read as follows:

§ 23.59 Takeoff distance and takeoff run.

For each commuter category airplane, the takeoff distance and, at the option of the applicant, the takeoff run, must be determined.

(a) * * *

(2) With all engines operating, 115 percent of the horizontal distance from the start of the takeoff to the point at which the airplane is 35 feet above the takeoff surface, determined by a procedure consistent with § 23.57.

(b) If the takeoff distance includes a clearway, the takeoff run is the greater of--

(1) The horizontal distance along the takeoff path from the start of the takeoff to a point equidistant between the liftoff point and the point at which the airplane is 35 feet above the takeoff surface as determined under § 23.57; or

(2) With all engines operating, 115 percent of the horizontal distance from the start of the takeoff to a point equidistant between the liftoff point and the point at which the airplane is 35 feet above the takeoff surface, determined by a procedure consistent with § 23.57.

14. A new § 23.63 is added to read as follows:

§ 23.63 Climb: general.

(a) Compliance with the requirements of §§ 23.65, 23.66, 23.67, 23.69, and 23.77 must be shown--

(1) Out of ground effect; and

(2) At speeds that are not less than those at which compliance with the powerplant cooling requirements of §§ 23.1041 to 23.1047 has been demonstrated; and

(3) Unless otherwise specified, with one engine inoperative, at a bank angle not exceeding 5 degrees.

(b) For normal, utility, and acrobatic category reciprocating engine-powered airplanes of 6,000 pounds or less maximum weight, compliance must be shown with § 23.65(a), § 23.67(a), where appropriate, and § 23.77(a) at maximum takeoff or landing weight, as appropriate, in a standard atmosphere.

(c) For normal, utility, and acrobatic category reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight, and turbine engine-powered airplanes in the normal, utility, and acrobatic category, compliance must be shown at weights as a function of airport altitude and ambient temperature, within the operational limits established for takeoff and landing, respectively, with--

(1) Sections 23.65(b) and 23.67(b)(1) and (2), where appropriate, for takeoff, and

(2) Section 23.67(b)(2), where appropriate, and § 23.77(b), for landing.

(d) For commuter category airplanes, compliance must be shown at weights as a function of airport altitude and ambient temperature within the operational limits established for takeoff and landing, respectively, with--

(1) Sections 23.67(c)(1), 23.67(c)(2), and 23.67(c)(3) for takeoff; and

(2) Sections 23.67(c)(3), 23.67(c)(4), and 23.77(c) for landing.

15. Section 23.65 is revised to read as follows:

§ 23.65 Climb: all engines operating.

(a) Each normal, utility, and acrobatic category reciprocating engine-powered airplane of 6,000 pounds or less maximum weight must have a steady climb gradient at sea level of at least 8.3 percent for landplanes or 6.7 percent for seaplanes and amphibians with--

- (1) Not more than maximum continuous power on each engine;
- (2) The landing gear retracted;
- (3) The wing flaps in the takeoff position(s); and
- (4) A climb speed not less than the greater of $1.1 V_{MC}$ and $1.2 V_{SI}$ for multiengine airplanes and not less than $1.2 V_{SI}$ for single-engine airplanes.

(b) Each normal, utility, and acrobatic category reciprocating engine-powered airplane of more than 6,000 pounds maximum weight and turbine engine-powered airplanes in the normal, utility, and acrobatic category must have a steady gradient of climb after takeoff of at least 4 percent with--

- (1) Takeoff power on each engine;
- (2) The landing gear extended, except that if the landing gear can be retracted in not more than seven seconds, the test may be conducted with the gear retracted;
- (3) The wing flaps in the takeoff position(s); and
- (4) A climb speed as specified in § 23.65(a)(4).

16. A new § 23.66 is added to read as follows:

§ 23.66 Takeoff climb: one-engine inoperative.

For normal, utility, and acrobatic category reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight, and turbine engine-powered airplanes in the normal, utility, and acrobatic category, the steady gradient of climb or descent must be determined at each weight, altitude, and ambient temperature within the operational limits established by the applicant with--

- (a) The critical engine inoperative and its propeller in the position it rapidly and automatically assumes;
- (b) The remaining engine(s) at takeoff power;
- (c) The landing gear extended, except that if the landing gear can be retracted in not more than seven seconds, the test may be conducted with the gear retracted;
- (d) The wing flaps in the takeoff position(s);
- (e) The wings level; and
- (f) A climb speed equal to that achieved at 50 feet in the demonstration of § 23.53.

17. Section 23.67 is revised to read as follows:

§ 23.67 Climb: one engine inoperative.

(a) For normal, utility, and acrobatic category reciprocating engine-powered airplanes of 6,000 pounds or less maximum weight, the following apply:

(1) Except for those airplanes that meet the requirements prescribed in § 23.562(d), each airplane with a V_{so} of more than 61 knots must be able to maintain a steady climb gradient of at least 1.5 percent at a pressure altitude of 5,000 feet with the--

(i) Critical engine inoperative and its propeller in the minimum drag position;

(ii) Remaining engine(s) at not more than maximum continuous power;

(iii) Landing gear retracted;

(iv) Wing flaps retracted; and

(v) Climb speed not less than $1.2 V_{s1}$.

(2) For each airplane that meets the requirements prescribed in § 23.562(d), or that has a V_{so} of 61 knots or less, the steady gradient of climb or descent at a pressure altitude of 5,000 feet must be determined with the--

(i) Critical engine inoperative and its propeller in the minimum drag position;

(ii) Remaining engine(s) at not more than maximum continuous power;

(iii) Landing gear retracted;

(iv) Wing flaps retracted; and

(v) Climb speed not less than $1.2 V_{s1}$.

(b) For normal, utility, and acrobatic category reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight, and turbine engine-powered airplanes in the normal, utility, and acrobatic category--

(1) The steady gradient of climb at an altitude of 400 feet above the takeoff surface must be measurably positive with the--

(i) Critical engine inoperative and its propeller in the minimum drag position;

(ii) Remaining engine(s) at takeoff power;

(iii) Landing gear retracted;

(iv) Wing flaps in the takeoff position(s); and

(v) Climb speed equal to that achieved at 50 feet in the demonstration of § 23.53.

(2) The steady gradient of climb must not be less than 0.75 percent at an altitude of 1,500 feet above the takeoff surface, or landing surface, as appropriate, with the--

(i) Critical engine inoperative and its propeller in the minimum drag position;

(ii) Remaining engine(s) at not more than maximum continuous power;

(iii) Landing gear retracted;

(iv) Wing flaps retracted; and

(v) Climb speed not less than $1.2 V_{S1}$.

(c) For commuter category airplanes, the following apply:

(1) Takeoff; landing gear extended. The steady gradient of climb at the altitude of the takeoff surface must be measurably positive for two-engine airplanes, not less than 0.3 percent for three-engine airplanes, or 0.5 percent for four-engine airplanes with--

(i) The critical engine inoperative and its propeller in the position it rapidly and automatically assumes;

(ii) The remaining engine(s) at takeoff power;

(iii) The landing gear extended, and all landing gear doors open;

(iv) The wing flaps in the takeoff position(s);

(v) The wings level; and

(vi) A climb speed equal to V_2 .

(2) Takeoff; landing gear retracted. The steady gradient of climb at an altitude of 400 feet above the takeoff surface must be not less than 2.0 percent for two-engine airplanes, 2.3

percent for three-engine airplanes, and 2.6 percent for four-engine airplanes with--

(i) The critical engine inoperative and its propeller in the position it rapidly and automatically assumes;

(ii) The remaining engine(s) at takeoff power;

(iii) The landing gear retracted;

(iv) The wing flaps in the takeoff position(s);

(v) A climb speed equal to V_2 .

(3) Enroute. The steady gradient of climb at an altitude of 1,500 feet above the takeoff or landing surface, as appropriate, must be not less than 1.2 percent for two-engine airplanes, 1.5 percent for three-engine airplanes, and 1.7 percent for four-engine airplanes with--

(i) The critical engine inoperative and its propeller in the minimum drag position;

(ii) The remaining engine(s) at not more than maximum continuous power;

(iii) The landing gear retracted;

(iv) The wing flaps retracted; and

(v) A climb speed not less than $1.2 V_{S1}$.

(4) Discontinued approach. The steady gradient of climb at an altitude of 400 feet above the landing surface must be not less than 2.1 percent for two-engine airplanes, 2.4 percent for three-engine airplanes, and 2.7 percent for four-engine airplanes, with--

(i) The critical engine inoperative and its propeller in the minimum drag position;

- (ii) The remaining engine(s) at takeoff power;
- (iii) Landing gear retracted;
- (iv) Wing flaps in the approach position(s) in which V_{s1} for these position(s) does not exceed 110 percent of the V_{s1} for the related all-engines-operating landing position(s); and
- (v) A climb speed established in connection with normal landing procedures but not exceeding $1.5 V_{s1}$.

18. A new § 23.69 is added to read as follows:

§ 23.69 Enroute climb/descent.

(a) All engines operating. The steady gradient and rate of climb must be determined at each weight, altitude, and ambient temperature within the operational limits established by the applicant with--

- (1) Not more than maximum continuous power on each engine;
- (2) The landing gear retracted;
- (3) The wing flaps retracted; and
- (4) A climb speed not less than $1.3 V_{s1}$.

(b) One engine inoperative. The steady gradient and rate of climb/descent must be determined at each weight, altitude, and ambient temperature within the operational limits established by the applicant with--

- (1) The critical engine inoperative and its propeller in the minimum drag position;
- (2) The remaining engine(s) at not more than maximum continuous power;
- (3) The landing gear retracted;

- (4) The wing flaps retracted; and
- (5) A climb speed not less than $1.2 V_{s1}$.

19. A new § 23.71 is added to read as follows:

§ 23.71 Glide: Single-engine airplanes.

The maximum horizontal distance traveled in still air, in nautical miles, per 1,000 feet of altitude lost in a glide, and the speed necessary to achieve this must be determined with the engine inoperative, its propeller in the minimum drag position, and landing gear and wing flaps in the most favorable available position.

20. A new § 23.73 is added to read as follows:

§ 23.73 Reference landing approach speed.

(a) For normal, utility, and acrobatic category reciprocating engine-powered airplanes of 6,000 pounds or less maximum weight, the reference landing approach speed, V_{REF} , must not be less than the greater of V_{MC} , determined in § 23.149(b) with the wing flaps in the most extended takeoff position, and $1.3 V_{so}$.

(b) For normal, utility, and acrobatic category reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight, and turbine engine-powered airplanes in the normal, utility, and acrobatic category, the reference landing approach speed, V_{REF} , must not be less than the greater of V_{MC} , determined in § 23.149(c), and $1.3 V_{so}$.

(c) For commuter category airplanes, the reference landing approach speed, V_{REF} , must not be less than the greater of 1.05 V_{MC} , determined in § 23.149(c), and 1.3 V_{SO} .

21. Section 23.75 is amended by revising the introductory text for the section; the introductory text of paragraph (a); and paragraphs (b), (d), (e), and (f); and by deleting paragraph (h); to read as follows:

§ 23.75 Landing distance.

The horizontal distance necessary to land and come to a complete stop from a point 50 feet above the landing surface must be determined, for standard temperatures at each weight and altitude within the operational limits established for landing, as follows:

(a) A steady approach at not less than V_{REF} , determined in accordance with § 23.73(a), (b), or (c), as appropriate, must be maintained down to the 50 foot height and--

* * * * *

(b) A constant configuration must be maintained throughout the maneuver.

* * * * *

(d) It must be shown that a safe transition to the balked landing conditions of § 23.77 can be made from the conditions that exist at the 50 foot height, at maximum landing weight, or at the maximum landing weight for altitude and temperature of § 23.63(c)(2) or (d)(2), as appropriate.

(e) The brakes must not be used so as to cause excessive wear of brakes or tires.

(f) Retardation means other than wheel brakes may be used if that means--

(1) Is safe and reliable; and

(2) Is used so that consistent results can be expected in service.

* * * * *

22. Section 23.77 is revised to read as follows:

§ 23.77 Balked landing.

(a) Each normal, utility, and acrobatic category reciprocating engine-powered airplane of 6,000 pounds or less maximum weight must be able to maintain a steady gradient of climb at sea level of at least 3.3 percent with--

(1) Takeoff power on each engine;

(2) The landing gear extended;

(3) The wing flaps in the landing position, except that if the flaps may safely be retracted in two seconds or less without loss of altitude and without sudden changes of angle of attack, they may be retracted; and

(4) A climb speed equal to V_{REF} , as defined in § 23.73(a).

(b) Each normal, utility, and acrobatic category reciprocating engine-powered airplane of more than 6,000 pounds maximum weight and each normal, utility, and acrobatic category turbine engine-powered airplane must be able to maintain a steady gradient of climb of at least 2.5 percent with--

(1) Not more than the power that is available on each engine eight seconds after initiation of movement of the power controls from minimum flight-idle position;

(2) The landing gear extended;

(3) The wing flaps in the landing position; and

(4) A climb speed equal to V_{REF} , as defined in § 23.73(b).

(c) Each commuter category airplane must be able to maintain a steady gradient of climb of at least 3.2 percent with--

(1) Not more than the power that is available on each engine eight seconds after initiation of movement of the power controls from the minimum flight idle position;

(2) Landing gear extended;

(3) Wing flaps in the landing position; and

(4) A climb speed equal to V_{REF} , as defined in § 23.73(c).

23. Section 23.143 is amended by revising paragraphs (a) and (c) to read as follows:

§ 23.143 General.

(a) The airplane must be safely controllable and maneuverable during all flight phases including--

(1) Takeoff;

(2) Climb;

(3) Level flight;

(4) Descent;

(5) Go-around; and

(6) Landing (power on and power off) with the wing flaps extended and retracted.

* * * * *

(c) If marginal conditions exist with regard to required pilot strength, the control forces required must be determined by quantitative tests. In no case may the control forces under the conditions specified in paragraphs (a) and (b) exceed those prescribed in the following table:

Values in pounds force applied to the relevant control	Pitch	Roll	Yaw
(a) For temporary application			
Stick-----	60	30	
Wheel (Two hands on rim)-	75	50	
Wheel (One hand on rim)--	50	25	
Rudder Pedal-----	-----	-----	150
(b) For prolonged application	10	5	20

24. Section 23.145 is amended by revising paragraphs (b) and (b)(2) through (b)(5); adding a new paragraph (b)(6); and revising paragraphs (c) and (d) to read as follows:

§ 23.145 Longitudinal control.

* * * * *

(b) Unless otherwise required, it must be possible to carry out the following maneuvers without requiring the application of single-handed control forces exceeding those specified in § 23.143(c). The trimming controls must not be adjusted during the maneuvers:

* * * * *

(2) With landing gear and flaps extended, power off, and the airplane as nearly as possible in trim at $1.3 V_{so}$, quickly apply takeoff power and retract the flaps as rapidly as possible to the recommended go around setting and allow the airspeed to transition from $1.3 V_{so}$ to $1.3 V_{s1}$. Retract the gear when a positive rate of climb is established.

(3) With landing gear and flaps extended, in level flight, power necessary to attain level flight at $1.1 V_{so}$, and the airplane as nearly as possible in trim, it must be possible to maintain approximately level flight while retracting the flaps as rapidly as possible with simultaneous application of not more than maximum continuous power. If gated flap positions are provided, the flap retraction may be demonstrated in stages with power and trim reset for level flight at $1.1 V_{s1}$ in the initial configuration for each stage--

(i) From the fully extended position to the most extended gated position;

(ii) Between intermediate gated positions, if applicable;

and (iii) From the least extended gated position to the fully retracted position.

(4) With power off, flaps and landing gear retracted and the airplane as nearly as possible in trim at $1.4 V_{s1}$, apply takeoff power rapidly while maintaining the same airspeed.

(5) With power off, landing gear and flaps extended, and the airplane as nearly as possible in trim at V_{REF} , obtain and maintain airspeeds between $1.1 V_{so}$ and either $1.7 V_{so}$ or V_{FE} ,

whichever is lower without requiring the application of two-handed control forces exceeding those specified in § 23.143(c).

(6) With maximum takeoff power, landing gear retracted, flaps in the takeoff position, and the airplane as nearly as possible in trim at V_{re} appropriate to the takeoff flap position, retract the flaps as rapidly as possible while maintaining constant speed.

(c) At speeds above V_{MO}/M_{MO} , and up to the maximum speed shown under § 23.251, a maneuvering capability of 1.5 g must be demonstrated to provide a margin to recover from upset or inadvertent speed increase.

(d) It must be possible, with a pilot control force of not more than 10 pounds, to maintain a speed of not more than V_{REF} during a power-off glide with landing gear and wing flaps extended, for any weight of the airplane, up to and including the maximum weight.

* * * * *

25. Section 23.147 is revised to read as follows:

§ 23.147 Directional and lateral control.

(a) For each multiengine airplane, it must be possible, while holding the wings level within five degrees, to make sudden changes in heading safely in both directions. This ability must be shown at $1.4 V_{s1}$ with heading changes up to 15 degrees, except that the heading change at which the rudder force corresponds to the limits specified in § 23.143 need not be exceeded, with the--

(1) Critical engine inoperative and its propeller in the minimum drag position;

(2) Remaining engines at maximum continuous power;

(3) Landing gear--

(i) Retracted; and

(ii) Extended; and

(4) Flaps retracted.

(b) For each multiengine airplane, it must be possible to regain full control of the airplane without exceeding a bank angle of 45 degrees, reaching a dangerous attitude or encountering dangerous characteristics, in the event of a sudden and complete failure of the critical engine, making allowance for a delay of two seconds in the initiation of recovery action appropriate to the situation, with the airplane initially in trim, in the following conditions:

(1) Maximum continuous power on each engine;

(2) The wing flaps retracted;

(3) The landing gear retracted;

(4) A speed equal to that at which compliance with § 23.69(a) has been shown; and

(5) All propeller controls in the position at which compliance with § 23.69(a) has been shown.

(c) For all airplanes, it must be shown that the airplane is safely controllable without the use of the primary lateral control system in any all-engine configuration(s) and at any speed or altitude within the approved operating envelope. It must also be shown that the airplane's flight characteristics are

not impaired below a level needed to permit continued safe flight and the ability to maintain attitudes suitable for a controlled landing without exceeding the operational and structural limitations of the airplane. If a single failure of any one connecting or transmitting link in the lateral control system would also cause the loss of additional control system(s), the above requirement is equally applicable with those additional systems also assumed to be inoperative.

26. Section 23.149 is revised to read as follows:

§ 23.149 Minimum control speed.

(a) V_{MC} is the calibrated airspeed at which, when the critical engine is suddenly made inoperative, it is possible to maintain control of the airplane with that engine still inoperative, and thereafter maintain straight flight at the same speed with an angle of bank of not more than 5 degrees. The method used to simulate critical engine failure must represent the most critical mode of powerplant failure with respect to controllability expected in service.

(b) V_{MC} for takeoff must not exceed $1.2 V_{S1}$, where V_{S1} is determined at the maximum takeoff weight. V_{MC} must be determined with the most unfavorable weight and center of gravity position and with the airplane airborne and the ground effect negligible, for the takeoff configuration(s) with--

(1) Maximum available takeoff power initially on each engine;

(2) The airplane trimmed for takeoff;

- (3) Flaps in the takeoff position(s);
- (4) Landing gear retracted; and
- (5) All propeller controls in the recommended takeoff position throughout.

(c) For all airplanes except reciprocating engine-powered airplanes of 6,000 pounds or less maximum weight, the conditions of paragraph (a) must also be met for the landing configuration with--

- (1) Maximum available takeoff power initially on each engine;
- (2) The airplane trimmed for an approach, with all engines operating, at V_{REF} , at an approach gradient equal to the steepest used in the landing distance demonstration of § 23.75;
- (3) Flaps in the landing position;
- (4) Landing gear extended; and
- (5) All propeller controls in the position recommended for approach with all engines operating.

(d) A minimum speed to intentionally render the critical engine inoperative must be established and designated as the safe, intentional, one-engine-inoperative speed, V_{SE} .

(e) At V_{MC} , the rudder pedal force required to maintain control must not exceed 150 pounds and it must not be necessary to reduce power of the operative engine(s). During the maneuver, the airplane must not assume any dangerous attitude and it must be possible to prevent a heading change of more than 20 degrees.

(f) At the option of the applicant, to comply with the requirements of § 23.51(c)(1), V_{MCG} may be determined. V_{MCG} is the

minimum control speed on the ground, and is the calibrated airspeed during the takeoff run at which, when the critical engine is suddenly made inoperative, it is possible to maintain control of the airplane using the rudder control alone (without the use of nosewheel steering), as limited by 150 pounds of force, and using the lateral control to the extent of keeping the wings level to enable the takeoff to be safely continued. In the determination of V_{MCG} , assuming that the path of the airplane accelerating with all engines operating is along the centerline of the runway, its path from the point at which the critical engine is made inoperative to the point at which recovery to a direction parallel to the centerline is completed may not deviate more than 30 feet laterally from the centerline at any point.

V_{MCG} must be established with--

- (1) The airplane in each takeoff configuration or, at the option of the applicant, in the most critical takeoff configuration;
- (2) Maximum available takeoff power on the operating engines;
- (3) The most unfavorable center of gravity;
- (4) The airplane trimmed for takeoff; and
- (5) The most unfavorable weight in the range of takeoff weights.

27. Section 23.153 is amended by revising the introductory paragraph and paragraphs (a), (b), and (c); and by adding new paragraph (d) to read as follows:

§ 23.153 Control during landings.

It must be possible, while in the landing configuration, to safely complete a landing without exceeding the one-hand control force limits specified in § 23.143(c) following an approach to land--

(a) At a speed of V_{REF} minus 5 knots;

(b) With the airplane in trim, or as nearly as possible in trim and without the trimming control being moved throughout the maneuver;

(c) At an approach gradient equal to the steepest used in the landing distance demonstration of § 23.75; and

(d) With only those power changes, if any, that would be made when landing normally from an approach at V_{REF} .

28. Section 23.155 is amended by revising the introductory text of paragraph (b) and paragraph (b)(1), and by adding a new paragraph (c) to read as follows:

§ 23.155 Elevator control force in maneuvers.

* * * * *

(b) The requirement of paragraph (a) of this section must be met at 75 percent of maximum continuous power for reciprocating engines, or the maximum continuous power for turbine engines, and with the wing flaps and landing gear retracted--

(1) In a turn, with the trim setting used for wings level flight at V_0 ; and

* * * * *

(c) There must be no excessive decrease in the gradient of the curve of stick force versus maneuvering load factor with increasing load factor.

29. Section 23.157 is amended by revising paragraph (d) to read as follows:

§ 23.157 Rate of roll.

* * * * *

(d) The requirement of paragraph (c) must be met when rolling the airplane in each direction in the following conditions--

- (1) Flaps in the landing position(s);
- (2) Landing gear extended;
- (3) All engines operating at the power for a 3 degree approach; and
- (4) The airplane trimmed at V_{REF} .

30. Section 23.161 is amended by revising paragraphs (a), (b)(1), (b)(2), (c), the introductory text of paragraph (d), and (d)(4), and by adding a new paragraph (e) to read as follows:

§ 23.161 Trim.

(a) General. Each airplane must meet the trim requirements of this section after being trimmed and without further pressure upon, or movement of, the primary controls or their corresponding trim controls by the pilot or the automatic pilot. In addition, it must be possible, in other conditions of loading, configuration, speed and power to ensure that the pilot will not

be unduly fatigued or distracted by the need to apply residual control forces exceeding those for prolonged application of § 23.143(c). This applies in normal operation of the airplane and, if applicable, to those conditions associated with the failure of one engine for which performance characteristics are established.

(b) * * *

(1) For normal, utility, and acrobatic category airplanes, at a speed of $0.9 V_R$, V_C , or V_{NO}/M_{NO} , whichever is lowest; and

(2) For commuter category airplanes, at all speeds from $1.4 V_{S1}$ to the lesser of V_R or V_{NO}/M_{NO} .

(c) Longitudinal trim. The airplane must maintain longitudinal trim under each of the following conditions:

(1) A climb with--

(i) Takeoff power, landing gear retracted, wing flaps in the takeoff position(s), at the speeds used in determining the climb performance required by § 23.65; and

(ii) Maximum continuous power at the speeds and in the configuration used in determining the climb performance required by § 23.69(a).

(2) Level flight at all speeds from the lesser of V_R and either V_{NO} or V_{NO}/M_{NO} (as appropriate), to $1.4 V_{S1}$, with the landing gear and flaps retracted.

(3) A descent at V_{NO} or V_{NO}/M_{NO} , whichever is applicable, with power off and with the landing gear and flaps retracted.

(4) Approach with landing gear extended and with--

(i) A 3 degree angle of descent, with flaps retracted and at a speed of $1.4 V_{S1}$;

(ii) A 3 degree angle of descent, flaps in the landing position(s) at V_{REF} ; and

(iii) An approach gradient equal to the steepest used in the landing distance demonstrations of § 23.75, flaps in the landing position(s) at V_{REF} .

(d) In addition, each multiengine airplane must maintain longitudinal and directional trim, and the lateral control force must not exceed 5 pounds at the speed used in complying with § 23.67(a), (b)(2), or (c)(3), as appropriate, with--

* * * * *

(4) Wing flaps retracted; and

* * * * *

(e) In addition, each commuter category airplane for which, in the determination of the takeoff path in accordance with § 23.57, the climb in the takeoff configuration at V_2 extends beyond 400 feet above the takeoff surface, it must be possible to reduce the longitudinal and lateral control forces to 10 pounds and 5 pounds, respectively, and the directional control force must not exceed 50 pounds at V_2 with--

(1) The critical engine inoperative and its propeller in the minimum drag position;

(2) The remaining engine(s) at takeoff power;

(3) Landing gear retracted;

(4) Wing flaps in the takeoff position(s); and

(5) An angle of bank not exceeding 5 degrees.

31. Section 23.175 is revised to read as follows:

§ 23.175 Demonstration of static longitudinal stability.

Static longitudinal stability must be shown as follows:

(a) Climb. The stick force curve must have a stable slope at speeds between 85 and 115 percent of the trim speed, with--

- (1) Flaps retracted;
- (2) Landing gear retracted;
- (3) Maximum continuous power; and

(4) The airplane trimmed at the speed used in determining the climb performance required by § 23.69(a).

(b) Cruise. With flaps and landing gear retracted and the airplane in trim with power for level flight at representative cruising speeds at high and low altitudes, including speeds up to V_{MO} or V_{MO}/M_{MO} , as appropriate, except that the speed need not exceed V_H --

(1) For normal, utility, and acrobatic category airplanes, the stick force curve must have a stable slope at all speeds within a range that is the greater of 15 percent of the trim speed plus the resulting free return speed range, or 40 knots plus the resulting free return speed range, above and below the trim speed, except that the slope need not be stable--

(i) At speeds less than $1.3 V_{S1}$; or

(ii) For airplanes with V_{NE} established under § 23.1505(a), at speeds greater than V_{NE} ; or

(iii) For airplanes with V_{MO}/M_{MO} established under § 23.1505(c), at speeds greater than V_{FC}/M_{FC} .

(2) For commuter category airplanes, the stick force curve must have a stable slope at all speeds within a range of 50 knots plus the resulting free return speed range, above and below the trim speed, except that the slope need not be stable--

- (i) At speeds less than $1.4 V_{s1}$; or
- (ii) At speeds greater than V_{rc}/M_{rc} ; or
- (iii) At speeds that require a stick force greater than 50 pounds.

(c) Landing. The stick force curve must have a stable slope at speeds between $1.1 V_{s1}$ and $1.8 V_{s1}$ with--

- (1) Flaps in the landing position;
- (2) Landing gear extended; and
- (3) The airplane trimmed at--
 - (i) V_{REF} , or the minimum trim speed if higher, with power off; and
 - (ii) V_{REF} with enough power to maintain a 3 degree angle of descent.

32. Section 23.177 is revised to read as follows:

§ 23.177 Static directional and lateral stability.

(a) The static directional stability, as shown by the tendency to recover from a wings level sideslip with the rudder free, must be positive for any landing gear and flap position appropriate to the takeoff, climb, cruise, approach, and landing configurations. This must be shown with symmetrical power up to maximum continuous power, and at speeds from $1.2 V_{s1}$ up to the maximum allowable speed for the condition being investigated.

The angle of sideslip for these tests must be appropriate to the type of airplane. At larger angles of sideslip, up to that at which full rudder is used or a control force limit in § 23.143 is reached, whichever occurs first, and at speeds from $1.2 V_{s1}$ to V_o , the rudder pedal force must not reverse.

(b) The static lateral stability, as shown by the tendency to raise the low wing in a sideslip, must be positive for all landing gear and flap positions. This must be shown with symmetrical power up to 75 percent of maximum continuous power at speeds above $1.2 V_{s1}$ in the takeoff configuration(s) and at speeds above $1.3 V_{s1}$ in other configurations, up to the maximum allowable speed for the configuration being investigated, in the takeoff, climb, cruise, and approach configurations. For the landing configuration, the power must be up to that necessary to maintain a 3 degree angle of descent in coordinated flight. The static lateral stability must not be negative at $1.2 V_{s1}$ in the takeoff configuration, or at $1.3 V_{s1}$ in other configurations. The angle of sideslip for these tests must be appropriate to the type of airplane, but in no case may the constant heading sideslip angle be less than that obtainable with a 10 degree bank, or if less, the maximum bank angle obtainable with full rudder deflection or 150 pound rudder force.

(c) Paragraph (b) of this section does not apply to acrobatic category airplanes certificated for inverted flight.

(d) In straight, steady slips at $1.2 V_{s1}$ for any landing gear and flap positions, and for any symmetrical power conditions up to 50 percent of maximum continuous power, the aileron and

rudder control movements and forces must increase steadily, but not necessarily in constant proportion, as the angle of sideslip is increased up to the maximum appropriate to the type of airplane. At larger slip angles, up to the angle at which full rudder or aileron control is used or a control force limit contained in § 23.143 is reached, the aileron and rudder control movements and forces must not reverse as the angle of sideslip is increased. Rapid entry into, and recovery from, a maximum sideslip considered appropriate for the airplane must not result in uncontrollable flight characteristics.

33. Section 23.201 is revised to read as follows:

§ 23.201 Wings level stall.

(a) It must be possible to produce and to correct roll by unreversed use of the rolling control and to produce and to correct yaw by unreversed use of the directional control, up to the time the airplane stalls.

(b) The wings level stall characteristics must be demonstrated in flight as follows. Starting from a speed at least 10 knots above the stall speed, the elevator control must be pulled back so that the rate of speed reduction will not exceed one knot per second until a stall is produced, as shown by either:

(1) An uncontrollable downward pitching motion of the airplane; or

(2) A downward pitching motion of the airplane that results from the activation of a stall avoidance device (for example, stick pusher); or

(3) The control reaching the stop.

(c) Normal use of elevator control for recovery is allowed after the downward pitching motion of (b)(1) or (b)(2) has unmistakably been produced, or after the control has been held against the stop for not less than the longer of two seconds or the time employed in the minimum steady flight speed determination of § 23.49.

(d) During the entry into and the recovery from the maneuver, it must be possible to prevent more than 15 degrees of roll or yaw by the normal use of controls.

(e) Compliance with the requirements of this section must be shown under the following conditions:

(1) Wing flaps. Retracted, fully extended, and each intermediate normal operating position.

(2) Landing gear. Retracted and extended.

(3) Cowl flaps. Appropriate to configuration.

(4) Power:

(i) Power off; and

(ii) 75 percent of maximum continuous power. However, if the power-to-weight ratio at 75 percent of maximum continuous power results in extreme nose-up attitudes, the test may be carried out with the power required for level flight in the landing configuration at maximum landing weight and a speed of

1.4 V_{so} , except that the power may not be less than 50 percent of maximum continuous power.

(5) Trim. The airplane trimmed at a speed as near 1.5 V_{s1} as practicable.

(6) Propeller. Full increase r.p.m. position for the power off condition.

34. Section 23.203 is amended by revising the heading and introductory text and by revising paragraph (a), the introductory text of paragraph (b), paragraphs (b)(4) and (b)(5), the introductory text of paragraph (c), and paragraphs (c)(1) and (c)(4), and by adding new paragraphs (b)(6) and (c)(6) to read as follows:

§ 23.203 Turning flight and accelerated turning stalls.

Turning flight and accelerated turning stalls must be demonstrated in tests as follows:

(a) Establish and maintain a coordinated turn in a 30 degree bank. Reduce speed by steadily and progressively tightening the turn with the elevator until the airplane is stalled, as defined in § 23.201(b). The rate of speed reduction must be constant, and--

(1) For a turning flight stall, may not exceed one knot per second; and

(2) For an accelerated turning stall, be 3 to 5 knots per second with steadily increasing normal acceleration.

(b) After the airplane has stalled, as defined in § 23.201(b), it must be possible to regain wings level flight by

normal use of the flight controls, but without increasing power and without--

* * * *

(4) Exceeding a bank angle of 60 degrees in the original direction of the turn or 30 degrees in the opposite direction in the case of turning flight stalls;

(5) Exceeding a bank angle of 90 degrees in the original direction of the turn or 60 degrees in the opposite direction in the case of accelerated turning stalls; and

(6) Exceeding the maximum permissible speed or allowable limit load factor.

(c) Compliance with the requirements of this section must be shown under the following conditions:

(1) Wing flaps: Retracted, fully extended, and each intermediate normal operating position;

* * * *

(4) Power:

(i) Power off; and

(ii) 75 percent of maximum continuous power. However, if the power-to-weight ratio at 75 percent of maximum continuous power results in extreme nose-up attitudes, the test may be carried out with the power required for level flight in the landing configuration at maximum landing weight and a speed of $1.4 V_{so}$, except that the power may not be less than 50 percent of maximum continuous power.

* * * *

(6) Propeller. Full increase r.p.m. position for the power off condition.

§ 23.205 [Removed]

35. Section 23.205 is removed.

36. Section 23.207 is amended by revising paragraphs (c) and (d), and by adding new paragraphs (e) and (f) to read as follows:

§ 23.207 Stall warning.

* * * * *

(c) During the stall tests required by § 23.201(b) and § 23.203(a)(1), the stall warning must begin at a speed exceeding the stalling speed by a margin of not less than 5 knots and must continue until the stall occurs.

(d) When following the procedures furnished in accordance with § 23.1585, the stall warning must not occur during a takeoff with all engines operating, a takeoff continued with one engine inoperative, or during an approach to landing.

(e) During the stall tests required by § 23.203(a)(2), the stall warning must begin sufficiently in advance of the stall for the stall to be averted by pilot action taken after the stall warning first occurs.

(f) For acrobatic category airplanes, an artificial stall warning may be mutable, provided that it is armed automatically during takeoff and rearmed automatically in the approach configuration.

37. Section 23.221 is revised to read as follows:

§ 23.221 Spinning.

(a) Normal category airplanes. A single-engine, normal category airplane must be able to recover from a one-turn spin or a three-second spin, whichever takes longer, in not more than one additional turn after initiation of the first control action for recovery, or demonstrate compliance with the optional spin resistant requirements of this section.

(1) The following apply to one turn or three second spins:

(i) For both the flaps-retracted and flaps-extended conditions, the applicable airspeed limit and positive limit maneuvering load factor must not be exceeded;

(ii) No control forces or characteristic encountered during the spin or recovery may adversely affect prompt recovery;

(iii) It must be impossible to obtain unrecoverable spins with any use of the flight or engine power controls either at the entry into or during the spin; and

(iv) For the flaps-extended condition, the flaps may be retracted during the recovery but not before rotation has ceased.

(2) At the applicant's option, the airplane may be demonstrated to be spin resistant by the following:

(i) During the stall maneuver contained in § 23.201, the pitch control must be pulled back and held against the stop.

Then, using ailerons and rudders in the proper direction, it must

be possible to maintain wings-level flight within 15 degrees of bank and to roll the airplane from a 30 degree bank in one direction to a 30 degree bank in the other direction;

(ii) Reduce the airplane speed using pitch control at a rate of approximately one knot per second until the pitch control reaches the stop; then, with the pitch control pulled back and held against the stop, apply full rudder control in a manner to promote spin entry for a period of seven seconds or through a 360 degree heading change, whichever occurs first. If the 360 degree heading change is reached first, it must have taken no fewer than four seconds. This maneuver must be performed first with the ailerons in the neutral position, and then with the ailerons deflected opposite the direction of turn in the most adverse manner. Power and airplane configuration must be set in accordance with § 23.201(e) without change during the maneuver. At the end of seven seconds or a 360 degree heading change, the airplane must respond immediately and normally to primary flight controls applied to regain coordinated, unstalled flight without reversal of control effect and without exceeding the temporary control forces specified by § 23.143(c); and

(iii) Compliance with §§ 23.201 and 23.203 must be demonstrated with the airplane in uncoordinated flight, corresponding to one ball width displacement on a slip-skid indicator, unless one ball width displacement cannot be obtained with full rudder, in which case the demonstration must be with full rudder applied.

(b) Utility category airplanes. A utility category airplane must meet the requirements of paragraph (a) of this section. In addition, the requirements of paragraph (c) of this section and § 23.807(b)(7) must be met if approval for spinning is requested.

(c) Acrobatic category airplanes. An acrobatic category airplane must meet the spin requirements of paragraph (a) of this section and § 23.807(b)(6). In addition, the following requirements must be met in each configuration for which approval for spinning is requested:

(1) The airplane must recover from any point in a spin up to and including six turns, or any greater number of turns for which certification is requested, in not more than one and one-half additional turns after initiation of the first control action for recovery. However, beyond three turns, the spin may be discontinued if spiral characteristics appear.

(2) The applicable airspeed limits and limit maneuvering load factors must not be exceeded. For flaps-extended configurations for which approval is requested, the flaps must not be retracted during the recovery.

(3) It must be impossible to obtain unrecoverable spins with any use of the flight or engine power controls either at the entry into or during the spin.

(4) There must be no characteristics during the spin (such as excessive rates of rotation or extreme oscillatory motion) that might prevent a successful recovery due to disorientation or incapacitation of the pilot.

38. Section 23.233 is amended by revising paragraph (a) to read as follows:

§ 23.233 Directional stability and control.

(a) A 90 degree cross-component of wind velocity, demonstrated to be safe for taxiing, takeoff, and landing must be established and must be not less than $0.2 V_{90}$.

* * * * *

39. Section 23.235 is revised to read as follows:

§ 23.235 Operation on unpaved surfaces.

The airplane must be demonstrated to have satisfactory characteristics and the shock-absorbing mechanism must not damage the structure of the airplane when the airplane is taxied on the roughest ground that may reasonably be expected in normal operation and when takeoffs and landings are performed on unpaved runways having the roughest surface that may reasonably be expected in normal operation.

40. A new § 23.237 is added to read as follows:

§ 23.237 Operation on water.

A wave height, demonstrated to be safe for operation, and any necessary water handling procedures for seaplanes and amphibians must be established.

41. Section 23.253 is amended by removing paragraph (b)(1) and by redesignating paragraphs (b)(2) and (b)(3) as paragraphs (b)(1) and (b)(2).

42. Section 23.562 is amended by revising paragraph (d) to read as follows:

§ 23.562 Emergency landing dynamic conditions.

* * * * *

(d) For all single-engine airplanes with a V_{so} of more than 61 knots at maximum weight, and those multiengine airplanes of 6,000 pounds or less maximum weight with a V_{so} of more than 61 knots at maximum weight that do not comply with § 23.67(a)(1);

* * * * *

§ 23.1323 [Amended]

43. Section 23.1323 is amended by removing paragraph (f).

44. Section 23.1325 is amended by revising paragraph (e), by deleting paragraph (f), and by redesignating paragraph (g) as (f), to read as follows:

§ 23.1325 Static pressure system.

* * * * *

(e) Each static pressure system must be calibrated in flight to determine the system error. The system error, in indicated pressure altitude, at sea-level, with a standard atmosphere, excluding instrument calibration error, may not exceed ± 30 feet per 100 knot speed for the appropriate

configuration in the speed range between $1.3 V_{so}$ with flaps extended, and $1.8 V_{s1}$ with flaps retracted. However, the error need not be less than 30 feet.

* * * * *

45. Section 23.1511 is amended by revising paragraphs (a)(1) and (a)(2) to read as follows:

§ 23.1511 Flap extended speed.

(a) * * *

(1) Not less than the minimum value of V_r allowed in § 23.345(b); and

(2) Not more than V_r established under § 23.345(a), (c), and (d).

* * * * *

46. Section 23.1521 is amended by revising paragraphs (b)(5) and (e) to read as follows:

§ 23.1521 Powerplant limitations.

* * * * *

(b) * * *

(5) The maximum allowable cylinder head (as applicable), liquid coolant and oil temperatures.

* * * * *

(e) Ambient temperature. For all airplanes except reciprocating engine-powered airplanes of 6,000 pounds or less maximum weight, ambient temperature limitations (including limitations for winterization installations if applicable) must

be established as the maximum ambient atmospheric temperature at which compliance with the cooling provisions of §§ 23.1041 through 23.1047 is shown.

47. Section 23.1543 is amended by adding a new paragraph (c) to read as follows:

§ 23.1543 Instrument markings: general.

* * * * *

(c) All related instruments must be calibrated in compatible units.

48. Section 23.1545 is amended by revising paragraphs (b)(5) and (b)(6) to read as follows:

§ 23.1545 Airspeed indicator.

* * * * *

(b) * * *

(5) For reciprocating multiengine-powered airplanes of 6,000 pounds or less maximum weight, for the speed at which compliance has been shown with § 23.69(b) relating to rate of climb at maximum weight and at sea level, a blue radial line.

(6) For reciprocating multiengine-powered airplanes of 6,000 pounds or less maximum weight, for the maximum value of minimum control speed, V_{MC} , (one-engine-inoperative) determined under § 23.149(b), a red radial line.

* * * * *

49. Section 23.1553 is revised to read as follows:

§ 23.1553 Fuel quantity indicator.

A red radial line must be marked on each indicator at the calibrated zero reading, as specified in § 23.1337(b)(1).

50. Section 23.1555 is amended by revising paragraph (e)(2) to read as follows:

§ 23.1555 Control markings.

* * * * *

(e) * * *

(2) Each emergency control must be red and must be marked as to method of operation. No control other than an emergency control shall be this color.

51. Section 23.1559 is revised to read as follows:

§ 23.1559 Operating limitations placard.

(a) There must be a placard in clear view of the pilot stating--

(1) That the airplane must be operated in accordance with the Airplane Flight Manual; and

(2) The certification category of the airplane to which the placards apply.

(b) For airplanes certificated in more than one category, there must be a placard in clear view of the pilot stating that other limitations are contained in the Airplane Flight Manual.

(c) There must be a placard in clear view of the pilot that specifies the kind of operations to which the operation of the

airplane is limited or from which it is prohibited under
§ 23.1525.

52. Section 23.1563 is amended by adding a new paragraph
(c) to read as follows:

§ 23.1563 Airspeed placards.

* * * * *

(c) For reciprocating multiengine-powered airplanes of more than 6,000 pounds maximum weight, and turbine engine-powered airplanes, the maximum value of the minimum control speed, V_{MC} , (one-engine-inoperative) determined under § 23.149(b).

53. Section 23.1567 is amended by adding a new paragraph
(d) to read as follows:

§ 23.1567 Flight maneuver placard.

* * * * *

(d) For acrobatic category airplanes and utility category airplanes approved for spinning, there must be a placard in clear view of the pilot--

(1) Listing the control actions for recovery from spinning maneuvers; and

(2) Stating that recovery must be initiated when spiral characteristics appear, or after not more than six turns or not more than any greater number of turns for which the airplane has been certificated.

54. Section 23.1581 is amended by adding new paragraphs (a)(3) and (c), and by revising the introductory text of paragraph (b)(2) and paragraph (d) to read as follows:

§ 23.1581 General.

(a) * * *

(3) Further information necessary to comply with the relevant operating rules.

(b) * * *

(2) The requirements of paragraph (b)(1) of this section do not apply to reciprocating engine-powered airplanes of 6,000 pounds or less maximum weight, if the following is met:

* * * * *

(c) The units used in the Airplane Flight Manual must be the same as those marked on the appropriate instruments and placards.

(d) All Airplane Flight Manual operational airspeeds, unless otherwise specified, must be presented as indicated airspeeds.

* * * * *

55. Section 23.1583 is amended by revising the introductory text of the section, and paragraphs (a), (a)(3)(i), (b), (c), (c)(3) through (c)(6), (d), (e), (f), and (g); by revising paragraphs (k), (l), and (m) and redesignating them as paragraphs (i), (j), and (k), respectively; and by adding new paragraphs (l), (m), (n), (o), and (p) to read as follows:

§ 23.1583 Operating limitations.

The Airplane Flight Manual must contain operating limitations determined under part 23, including the following--

(a) Airspeed limitations.

* * * * *

(3) In addition, for turbine powered commuter category airplanes--

(i) The maximum operating limit speed, V_{MO}/M_{MO} and a statement that this speed must not be deliberately exceeded in any regime of flight (climb, cruise or descent) unless a higher speed is authorized for flight test or pilot training;

* * * * *

(b) Powerplant limitations.

* * * * *

(c) Weight.

* * * * *

(3) For normal, utility, and acrobatic category reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight and for turbine engine-powered airplanes in the normal, utility, and acrobatic category, performance operating limitations as follows--

(i) The maximum takeoff weight for each airport altitude and ambient temperature within the range selected by the applicant at which the airplane complies with the climb requirements of § 23.63(c)(1).

(ii) The maximum landing weight for each airport altitude and ambient temperature within the range selected by the

applicant at which the airplane complies with the climb requirements of § 23.63(c)(2).

(4) For commuter category airplanes, the maximum takeoff weight for each airport altitude and ambient temperature within the range selected by the applicant at which--

(i) The airplane complies with the climb requirements of § 23.63(d)(1); and

(ii) The accelerate-stop distance determined under § 23.55 is equal to the available runway length plus the length of any stopway, if utilized; and either:

(iii) The takeoff distance determined under § 23.59(a) is equal to the available runway length; or

(iv) At the option of the applicant, the takeoff distance determined under § 23.59(a) is equal to the available runway length plus the length of any clearway and the takeoff run determined under § 23.59(b) is equal to the available runway length.

(5) For commuter category airplanes, the maximum landing weight for each airport altitude within the range selected by the applicant at which--

(i) The airplane complies with the climb requirements of § 23.63(d)(2) for ambient temperatures within the range selected by the applicant; and

(ii) The landing distance determined under § 23.75 for standard temperatures is equal to the available runway length.

(6) The maximum zero wing fuel weight, where relevant, as established in accordance with § 23.343.

(d) Center of gravity. The established center of gravity limits.

(e) Maneuvers. The following authorized maneuvers, appropriate airspeed limitations, and unauthorized maneuvers, as prescribed in this section.

(1) Normal category airplanes. No acrobatic maneuvers, including spins, are authorized.

(2) Utility category airplanes. A list of authorized maneuvers demonstrated in the type flight tests, together with recommended entry speeds and any other associated limitations. No other maneuver is authorized.

(3) Acrobatic category airplanes. A list of approved flight maneuvers demonstrated in the type flight tests, together with recommended entry speeds and any other associated limitations.

(4) Acrobatic category airplanes and utility category airplanes approved for spinning. Spin recovery procedure established to show compliance with § 23.221(c).

(5) Commuter category airplanes. Maneuvers are limited to any maneuver incident to normal flying, stalls (except whip stalls) and steep turns in which the angle of bank is not more than 60 degrees.

(f) Maneuver load factor. The positive limit load factors in g's, and, in addition, the negative limit load factor for acrobatic category airplanes.

(g) Minimum flight crew. The number and functions of the minimum flight crew determined under § 23.1523.

* * * * *

(i) Maximum operating altitude. The maximum altitude established under § 23.1527.

(j) Maximum passenger seating configuration. The maximum passenger seating configuration.

(k) Allowable lateral fuel loading. The maximum allowable lateral fuel loading differential, if less than the maximum possible.

(l) Baggage and cargo loading. The following information for each baggage and cargo compartment or zone--

(1) The maximum allowable load; and

(2) The maximum intensity of loading.

(m) Systems. Any limitations on the use of airplane systems and equipment.

(n) Ambient temperatures. Where appropriate, maximum and minimum ambient air temperatures for operation.

(o) Smoking. Any restrictions on smoking in the airplane.

(p) Types of surface. A statement of the types of surface on which operations may be conducted. (See § 23.45(g) and § 23.1587(a)(4), (c)(2), and (d)(4)).

56. Section 23.1585 is revised to read as follows:

§ 23.1585 Operating procedures.

(a) For all airplanes, information concerning normal, abnormal (if applicable), and emergency procedures and other pertinent information necessary for safe operation and the

achievement of the scheduled performance must be furnished, including--

(1) An explanation of significant or unusual flight or ground handling characteristics;

(2) The maximum demonstrated values of crosswind for takeoff and landing, and procedures and information pertinent to operations in crosswinds;

(3) A recommended speed for flight in rough air. This speed must be chosen to protect against the occurrence, as a result of gusts, of structural damage to the airplane and loss of control (for example, stalling);

(4) Procedures for restarting any turbine engine in flight, including the effects of altitude; and

(5) Procedures, speeds, and configuration(s) for making a normal approach and landing, in accordance with §§ 23.73 and 23.75, and a transition to the balked landing condition.

(6) For seaplanes and amphibians, water handling procedures and the demonstrated wave height.

(b) In addition to paragraph (a) of this section, for all single-engine airplanes, the procedures, speeds, and configuration(s) for a glide following engine failure, in accordance with § 23.71 and the subsequent forced landing, must be furnished.

(c) In addition to paragraph (a) of this section, for all multiengine airplanes, the following information must be furnished:

(1) Procedures, speeds, and configuration(s) for making an approach and landing with one engine inoperative;

(2) Procedures, speeds, and configuration(s) for making a balked landing with one engine inoperative and the conditions under which a balked landing can be performed safely, or a warning against attempting a balked landing;

(3) The V_{ssz} determined in § 23.149; and

(4) Procedures for restarting any engine in flight including the effects of altitude.

(d) In addition to paragraphs (a) and either (b) or (c) of this section, as appropriate, for all normal, utility, and acrobatic category airplanes, the following information must be furnished:

(1) Procedures, speeds, and configuration(s) for making a normal takeoff, in accordance with § 23.51(a) and (b), and § 23.53(a) and (b), and the subsequent climb, in accordance with § 23.65 and § 23.69(a).

(2) Procedures for abandoning a takeoff due to engine failure or other cause.

(e) In addition to paragraphs (a), (c), and (d) of this section, for all normal, utility, and acrobatic category multiengine airplanes, the information must include the following:

(1) Procedures and speeds for continuing a takeoff following engine failure and the conditions under which takeoff can safely be continued, or a warning against attempting to continue the takeoff.

(2) Procedures, speeds, and configurations for continuing a climb following engine failure, after takeoff, in accordance with § 23.67, or enroute, in accordance with § 23.69(b).

(f) In addition to paragraphs (a) and (c) of this section, for commuter category airplanes, the information must include the following:

(1) Procedures, speeds, and configuration(s) for making a normal takeoff.

(2) Procedures and speeds for carrying out an accelerate-stop in accordance with § 23.55.

(3) Procedures and speeds for continuing a takeoff following engine failure in accordance with § 23.59(a)(1) and for following the flight path determined with § 23.57 and § 23.61(a).

(g) For multiengine airplanes, information identifying each operating condition in which the fuel system independence prescribed in § 23.953 is necessary for safety must be furnished, together with instructions for placing the fuel system in a configuration used to show compliance with that section.

(h) For each airplane showing compliance with § 23.1353(g)(2) or (g)(3), the operating procedures for disconnecting the battery from its charging source must be furnished.

(i) Information on the total quantity of usable fuel for each fuel tank, and the effect on the usable fuel quantity, as a result of a failure of any pump, must be furnished.

(j) Procedures for the safe operation of the airplane's systems and equipment, both in normal use and in the event of malfunction, must be furnished.

57. Section 23.1587 is revised to read as follows:

§ 23.1587 Performance information.

Unless otherwise prescribed, performance information must be provided over the altitude and temperature ranges required by § 23.45(b).

(a) For all airplanes, the following information must be furnished--

(1) The stalling speeds V_{so} and V_{s1} with the landing gear and wing flaps retracted, determined at maximum weight under § 23.49, and the effect on these stalling speeds of angles of bank up to 60 degrees;

(2) The steady rate and gradient of climb with all engines operating, determined under § 23.69(a);

(3) The landing distance, determined under § 23.75 for each airport altitude and standard temperature, and the type of surface for which it is valid;

(4) The effect on landing distances of operation on other than smooth hard surfaces, when dry, determined under § 23.45(g); and

(5) The effect on landing distances of runway slope and 50 percent of the headwind component and 150 percent of the tailwind component.

(b) In addition to paragraph (a) of this section, for all normal, utility, and acrobatic category reciprocating engine-powered airplanes of 6,000 pounds or less maximum weight, the steady angle of climb/descent, determined under § 23.77(a), must be furnished.

(c) In addition to paragraphs (a) and (b) of this section, if appropriate, for normal, utility, and acrobatic category airplanes, the following information must be furnished--

(1) The takeoff distance, determined under § 23.53 and the type of surface for which it is valid.

(2) The effect on takeoff distance of operation on other than smooth hard surfaces, when dry, determined under § 23.45(g);

(3) The effect on takeoff distance of runway slope and 50 percent of the headwind component and 150 percent of the tailwind component;

(4) For multiengine reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight and multiengine turbine powered airplanes, the one-engine-inoperative takeoff climb/descent gradient, determined under § 23.66;

(5) For multiengine airplanes, the enroute rate and gradient of climb/descent with one engine inoperative, determined under § 23.69(b); and

(6) For single-engine airplanes, the glide performance determined under § 23.71.

(d) In addition to paragraph (a) of this section, for commuter category airplanes, the following information must be furnished--

- (1) The accelerate-stop distance determined under § 23.55;
- (2) The takeoff distance determined under § 23.59(a);
- (3) At the option of the applicant, the takeoff run determined under § 23.59(b);
- (4) The effect on accelerate-stop distance, takeoff distance and, if determined, takeoff run, of operation on other than smooth hard surfaces, when dry, determined under § 23.45(g);
- (5) The effect on accelerate-stop distance, takeoff distance, and if determined, takeoff run, of runway slope and 50 percent of the headwind component and 150 percent of the tailwind component;
- (6) The net takeoff flight path determined under § 23.61(b);
- (7) The enroute gradient of climb/descent with one engine inoperative, determined under § 23.69(b);
- (8) The effect, on the net takeoff flight path and on the enroute gradient of climb/descent with one engine inoperative, of 50 percent of the headwind component and 150 percent of the tailwind component;
- (9) Overweight landing performance information (determined by extrapolation and computed for the range of weights between the maximum landing and maximum takeoff weights) as follows--
 - (i) The maximum weight for each airport altitude and ambient temperature at which the airplane complies with the climb requirements of § 23.63(d)(2); and
 - (ii) The landing distance determined under § 23.75 for each airport altitude and standard temperature.

(10) The relationship between IAS and CAS determined in accordance with § 23.1323(b) and (c).

(11) The altimeter system calibration required by § 23.1325(e).

58. Section 23.1589 is amended by revising paragraph (b) to read as follows:

§ 23.1589 Loading information.

* * * * *

(b) Appropriate loading instructions for each possible loading condition between the maximum and minimum weights established under § 23.25, to facilitate the center of gravity remaining within the limits established under § 23.23.

Appendix E - [Removed]

59. Appendix E is removed.

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